Annual Report
for Calendar Year 2007
on

Status of Implementation of Integrated Safety Management at the Department of Energy

June 2008

Office of Health, Safety and Security
Office of the Secretary of Energy
U.S. Department of Energy

HSS
Office of Health, Safety and Security

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1 Introduction

In November 2006, the Department of Energy (DOE) issued a revision to its Integrated Safety Management (ISM) Manual, which includes a new requirement for the DOE Chief Health, Safety and Security Officer to "Provide an annual report to the Secretary concerning the overall status of implementation of ISM at DOE and identifying strengths, best practices, common weaknesses, and opportunities for improvement."

DOE established its ISM policy in 1996. The original ISM policy was based, in part, on a paper developed by the DOE in response to a question by the Defense Nuclear Facilities Safety Board. Since then, the policy and associated manuals and guidance have been developed and enhanced as a cooperative effort involving DOE Headquarters and the field. The continued refinement of ISM directives and guidance is the responsibility of the Office of Health, Safety and Security (HSS), with significant input from DOE line management and contractors through such organizations as the ISM Champions and the Energy Facilities Contractor Group (EFCOG).

Under the leadership of the Chief Health, Safety and Security Officer, HSS is responsible for many aspects of the DOE ISM program. Specifically, HSS has ISM responsibilities in such areas as policy, assistance, analysis, and independent oversight and has a number of ongoing activities relevant to ISM. As examples:

- In the area of policy and assistance, the HSS Office of Health and Safety is leading a number of DOE initiatives to enhance DOE safety-related directives and to enhance ISM implementation through technical assistance to the line, issuance of an ISM Manual, sponsoring workshops and conferences, promoting site efforts to achieve Voluntary Protection Program status, and leading efforts to improve and revitalize ISM.

- In the area of analysis, the HSS Office of Corporate Safety Analysis performs various efforts in support of ISM, such as analyzing operating data to identify trends and areas requiring increased attention, promoting behavior-based safety and other efforts to address human performance issues, and communicating lessons learned.

- In the area of oversight, the HSS Office of Independent Oversight performs inspections and other oversight activities that focus specifically on ISM implementation at the site level and also reviews selected areas on a DOE-wide basis to identify deficiencies for corrective action and opportunities for improvement.

HSS, as the "corporate" safety office for DOE, also serves in an integrating and coordinating role for many DOE-wide initiatives and efforts. In this role, HSS works closely with DOE line management, contractor management, and other groups, such as the EFCOG, on efforts to achieve DOE goals and improve ISM

policies, programs, and implementation. For example, an HSS manager serves as the Co-Chair of the ISM Champions Council, which leads and coordinates many DOE-wide efforts to promote and improve ISM.

At the direction of the Chief Health, Safety and Security Officer, the HSS Office of Independent Oversight (Independent Oversight) prepared this Annual Report for 2007 based largely on its inspection activities conducted in calendar year 2007; these reviews focused on ISM implementation at the site level and thus provide a good source of information for the annual reporting requirement, as specified in the ISM Manual. To provide broader perspectives, Independent Oversight also incorporated information from other Independent Oversight summary reports, as well as information developed by other HSS offices, such as performance trends, and ensured that other HSS offices concurred with the results.

This HSS Annual Report includes an overall assessment (see Section 2), which discusses trends and HSS's overall conclusions about the status of ISM at DOE sites. This report also provides an assessment and identifies strengths/best practices, weaknesses, and opportunities for improvement for four major elements of ISM, as follows:

- Work Planning and Control (see Section 3)
- Essential System Functionality (see Section 4)
- Contractor Assurance Systems (see Section 5)
- DOE Line Management Oversight (see Section 6).

This report is based largely on the insights from Independent Oversight inspection activities from January 2007 through December 2007. Independent Oversight performs environment, safety, and health (ES&H) program inspections as its primary mechanism for evaluating and reporting on ISM performance. These inspections evaluate selected aspects of DOE[1] site ISM programs, with a focus on implementation of ISM, and DOE contractor and line management performance. The sites inspected by Independent Oversight during the reporting period are listed in Table 1. The table also identifies the DOE program office that has primary management responsibility for each site – the National Nuclear Security Administration (NNSA), the Office of Environmental Management (EM), the Office of Science (SC), or the Office of Nuclear Energy (NE).

Table 1. Sites Inspected by Independent Oversight During the Reporting Period

ISM INSPECTION SITE	HEADQUARTERS PROGRAM OFFICE
Lawrence Livermore National Laboratory (LLNL)	NNSA
Nevada Test Site (NTS)	NNSA
Idaho National Laboratory (INL) Materials and Fuels Complex (MFC)	NE
Idaho Cleanup Project (ICP)	EM
Brookhaven National Laboratory (BNL)	SC
Los Alamos National Laboratory (LANL)	NNSA

All of the 2007 inspections included an evaluation of work planning and control, contractor assurance systems, and DOE line management oversight. Essential system functionality was evaluated at four of the inspected sites (LLNL, NTS, INL-MFC, and LANL).

[1] DOE, as used in this report, includes the National Nuclear Security Administration.

The sites reviewed by Independent Oversight in 2007 provide good insight into ISM implementation across the Department; however, it should be recognized that Independent Oversight inspections provide a "snapshot in time" of ISM implementation at a selected sample of facilities and activities at each site. Therefore, the results in Sections 3 through 6 need to be viewed in the context of the sampling approach, with the recognition that a different sample of sites could reveal additional trends, strengths, best practices, weaknesses, and opportunities for improvement. Further, many of the deficiencies at specific DOE sites noted during Independent Oversight inspections have been, or are being, addressed through subsequent corrective actions for site-specific findings. In addition, most of the Independent Oversight inspections focus on higher-hazard DOE sites, such as nuclear facilities and multi-program laboratories.

Notwithstanding the limitations of the sampling approach, HSS believes that the results presented in Sections 3 through 6 provide valid perspectives on the status of ISM across DOE for a number of reasons. First, the results of the 2007 Independent Oversight inspections are consistent with those of previous years. Independent Oversight has been performing inspections of ISM implementation at DOE sites since the inception of ISM. During the past few years, Independent Oversight has performed inspections of almost all major DOE sites. The results of inspections for the past few years reveal trends, positive attributes, and weaknesses that are similar to those identified during 2007 inspections. Where appropriate, similar longstanding observations about ISM performance in this report were referenced to previous Independent Oversight summary reports. Second, HSS regularly examines information from other sources, such as injury and illness data and event reports, as part of its inspections and analysis efforts. The results in this Annual Report are consistent with the analyses performed on the other sources of ES&H data.

The assessment, weaknesses, and opportunities for improvement in this Annual Report were developed based on a collective analysis of the inspection results during this reporting period. In all cases, the weaknesses identified in this report reflect deficiencies that were identified at multiple facilities. Thus, these weaknesses are not isolated instances. While not evident at every facility, the weaknesses identified in this report were seen often enough at DOE sites to indicate a concern that needs to be evaluated for applicability across DOE in accordance with DOE Order 210.2, *DOE Corporate Operating Experience Program,* and DOE Order 226.1A, *Implementation of Department of Energy Oversight Policy.*

The opportunities for improvement are targeted primarily on actions that should be considered by DOE line managers, as well as DOE managers with responsibilities for ES&H and/or ISM policies and assistance. The opportunities for improvement are not intended to be prescriptive or mandatory. Rather, they are offered to DOE managers to be reviewed and evaluated by the responsible line management organizations and accepted, rejected, or modified as appropriate, in accordance with programmatic and site-specific hazards, objectives, and priorities.

2 Overall Assessment

Since its inception in 1996, ISM has had a major positive impact on ES&H programs and performance at DOE sites. ISM has ensured that line management is responsible for and involved in ES&H programs rather than viewing ES&H as a function performed primarily by safety specialists. ISM and the corresponding management focus on performance measures, such as injury and illness rates, have led to significant improvements in ES&H performance since its inception. As shown in Figure 1, the DOE injury and illness rates show a significant downward trend. Further, DOE sites have achieved injury and illness rates that are considerably lower (typically less than half) than those for general industry.

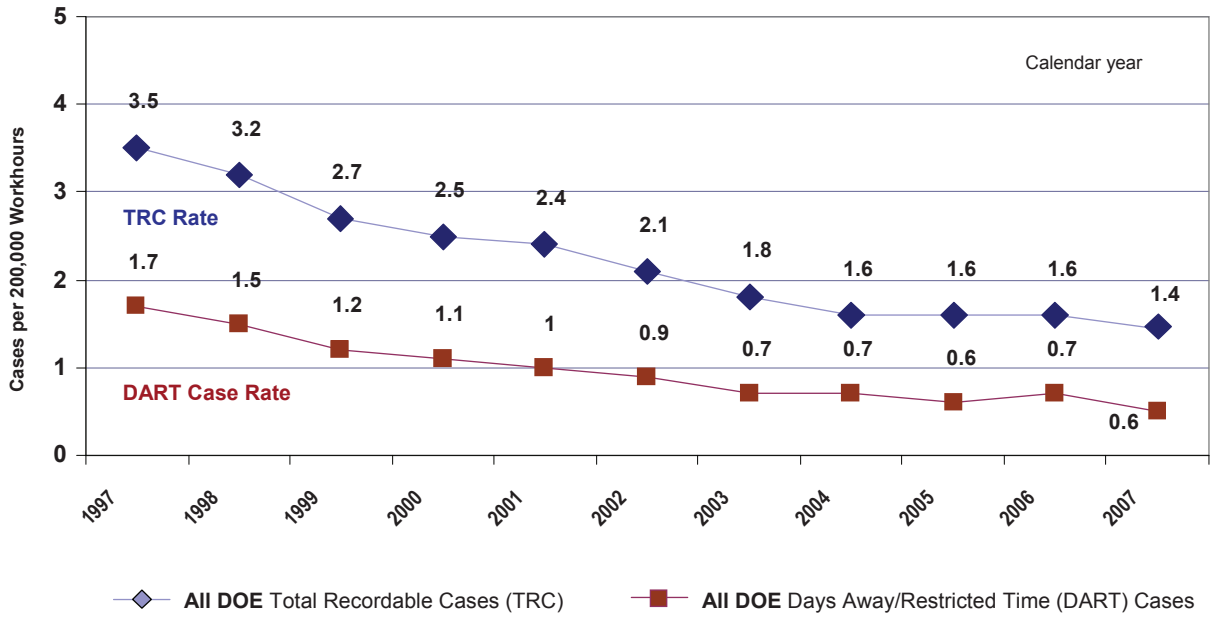

Figure 1. Improving DOE Safety Performance – Injury and Illness Trends for DOE Sites, 1997 to 2007

As shown in Figure 2, DOE has also shows a trend of reducing the overall radiation dose to workers. Figure 2 shows the collective total effective dose equivalent (TEDE), which is an indicator of the overall amount of radiation dose received during the conduct of operations at DOE. The TEDE comprises the external deep dose equivalent, which includes neutron and photon radiation, and the internal committed effective dose equivalent (CEDE), which results from the intake of radioactive material into the body. As noted in the HSS

Office of Corporate Safety Analysis's annual DOE Occupational Radiation Exposure Report for 2006, the collective TEDE has decreased for a number of reasons (e.g., decreases in the amount of work performed that directly involves radioactive materials, and completion of cleanup operations at several facilities, such as closure of Rocky Flats) and cannot be solely attributed to improved radiation safety practices. Nevertheless, the overall long-term downward trend in radiation dose to workers is an encouraging indicator that ISM is continuing to have a positive impact on worker safety. In addition, HSS's analysis of the event data shows that DOE sites have been effective in avoiding events that cause a dose in excess of regulatory limits (5 rem) since 2003.

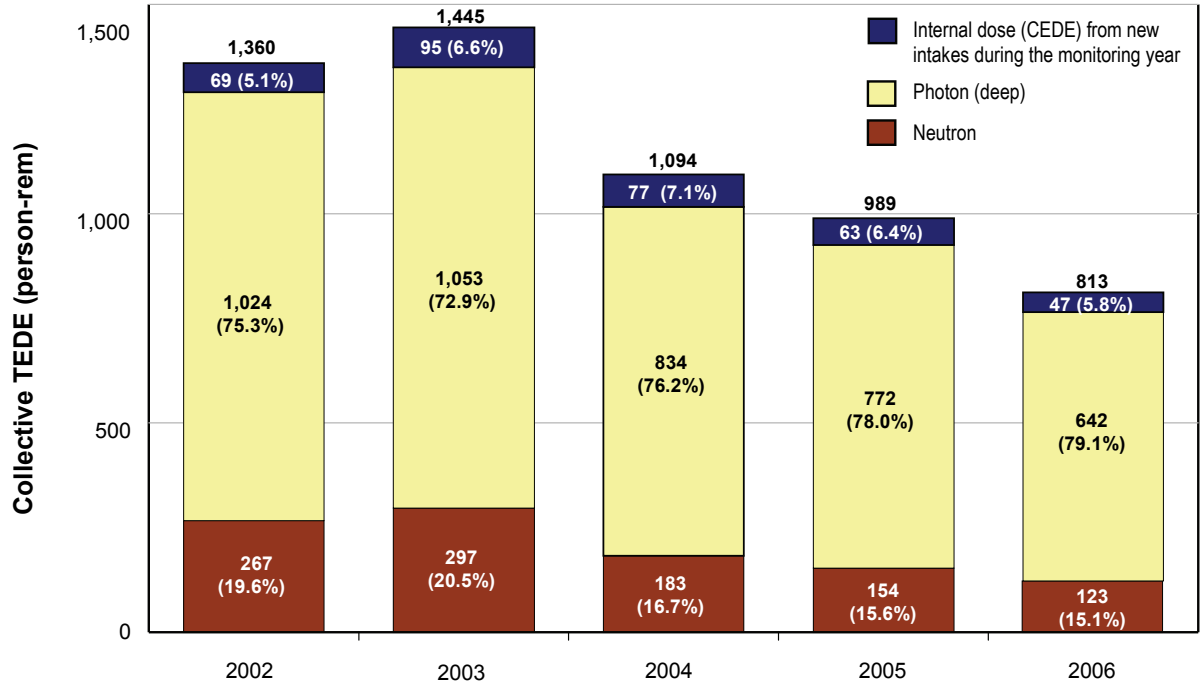

Figure 2. Radiation Dose Trends

In addition, DOE has issued new regulations and new or revised directives in the past few years that are having a positive impact on ISM and ES&H programs. 10 CFR 851, *Worker Safety and Health Program Rule*, became enforceable in May 2007; the issuance of enforceable regulations and the requirement for a comprehensive safety and health plan have prompted DOE site contractors to reevaluate and improve various aspects of their safety and health programs. For example, the effort has highlighted the need for significant improvements in workplace monitoring programs to ensure that workers are fully protected from exposure to chemicals and other health hazards (e.g., noise). DOE Order 226.1, *Implementation of DOE Oversight Policy*, provides a well-defined structure and clear expectations for contractor assurance systems and DOE oversight, and is having a positive impact on ES&H programs. The new/revised requirements for lessons learned, cognizant system engineers, and safety system oversight – programs that apply to safety systems at nuclear facilities (e.g., ventilation) – are also having positive impacts on ISM programs at DOE sites. All of these requirements are driving improvements but are in various stages of development and implementation, so their full benefits have not yet been realized. Continued attention is needed to ensure that they are effectively implemented and achieve the intended results.

Notwithstanding the low injury/illness rates and recent and ongoing improvements in directives and programs, many aspects of ISM need continued and increased management attention, as discussed below, to ensure that needed improvements are made. There are a few instances where ISM elements (e.g., site office oversight) have degraded at some sites. In addition, while DOE injury and illness rates are low and improving, DOE rates are not yet world class, and as seen in Figure 1, improvements in injury and illness rates have been less pronounced in recent years.

Figure 3 summarizes the ratings that were assigned during 2007 Independent Oversight inspections.[2] These ratings are intended to highlight areas for management focus on a site-specific basis. As shown in Figure 3, many of the areas evaluated in 2007 need improvement, and significant management attention is needed to address significant weaknesses that are prevalent in a number of important areas, including engineering design of nuclear safety systems, safety system oversight, and DOE line management oversight.

Figure 4 provides data derived from Occurrence Reporting and Processing System (ORPS) reports. The ORPS data shows that 86 percent of 2007 ORPS reports identified deficiencies in one or more of the ISM core functions and that deficiencies in hazards analysis, hazard controls, and ISM implementation (i.e., performing work within controls) are the most prevalent causes.[3]

The current status and trends for the four major ISM elements that were analyzed in this Annual Report are discussed below.

Work planning and control programs at DOE sites are generally well defined and comprehensive at the institutional level. At most sites, work planning and control programs are maturing and improving in some areas at the facility and activity levels. With some exceptions, these programs are effectively implemented for many hazards, such as nuclear material operations, explosives, and most physical safety hazards. However, they are often less effective for some health hazards, such as exposure to noise, fumes, and some chemicals. Also, there are still many instances of weaknesses in the rigor of implementation of site work control processes, resulting in non-compliance with requirements. Compliance deficiencies are due, in part, to requirements that are not clearly communicated to workers and managers who do not sufficiently establish expectations for full compliance with processes and procedures and who tacitly accept non-compliant behavior (e.g., not wearing proper personal protective equipment).

As shown in Figure 3A, ratings for the first four core functions (CFs) of ISM, which are the elements of an effective work planning and control system, show that many elements were rated as Effective Performance, and only one element was rated as Significant Weakness. However, the inspection results (including ratings) for 2007 and recent years indicate that additional improvement is needed in most of the areas that were reviewed, with particular attention to hazards analysis, identification and implementation of hazard controls, and communication of and worker compliance with established requirements. The Independent Oversight results indicate that increased management attention is warranted to renew the focus on improving work planning and control, with particular attention to worker health hazards.

In the area of **essential system functionality,** DOE sites have operated their nuclear facilities with no major accidents or events that significantly impacted the public or the environment in recent years. Independent

[2] The number of inspections and the number of ratings do not correspond on a one-to-one basis because different topics were evaluated and rated on each inspection, and some topics were not evaluated during some inspections. Furthermore, in some inspections where multiple organizations were evaluated, separate ratings were assigned to each organization.

[3] The percentages for the five categories add up to more than 100 percent because ORPS reports may identify more than one factor as a contributor to an event.

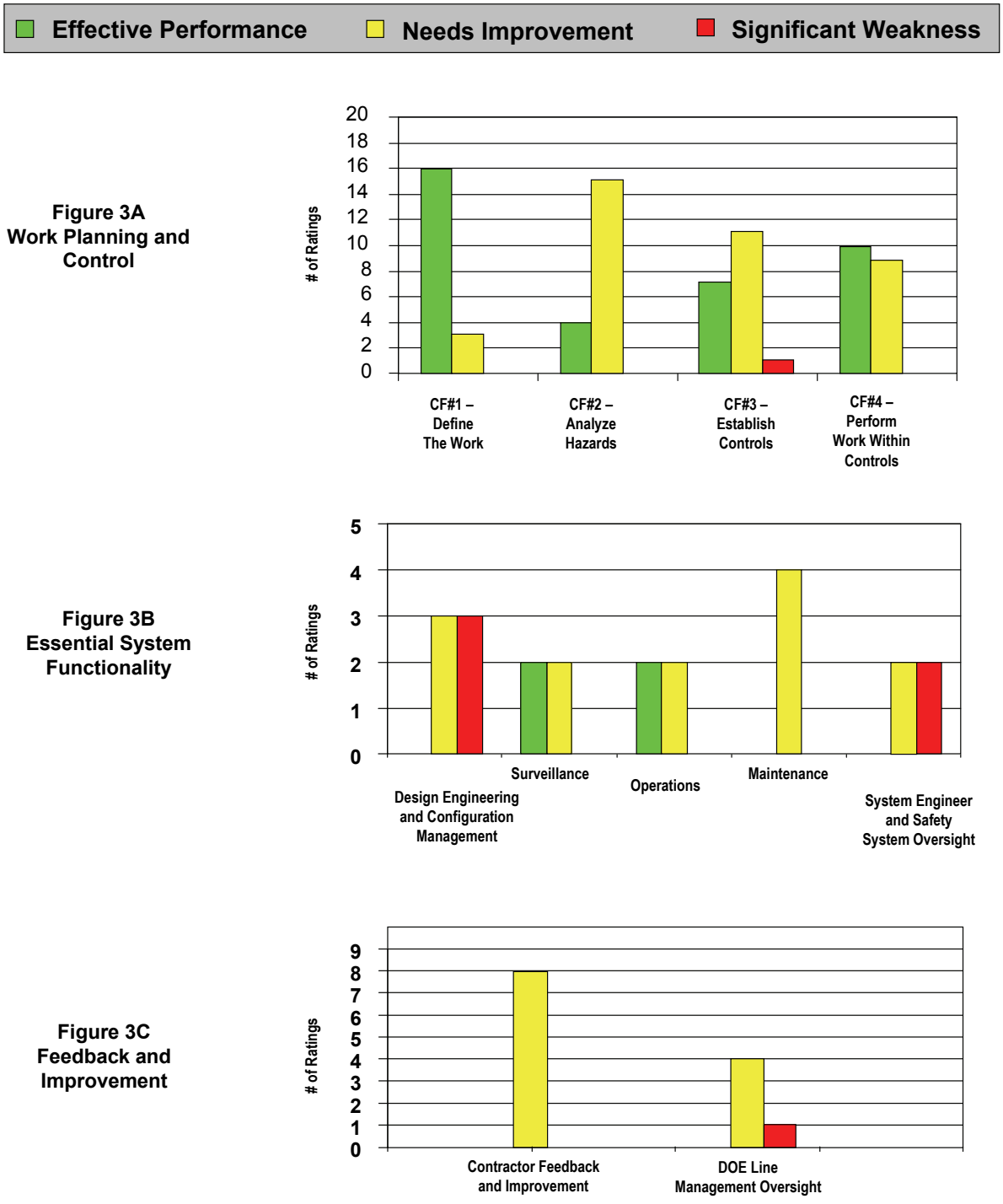

Figure 3. Ratings from 2007 Independent Oversight Inspections

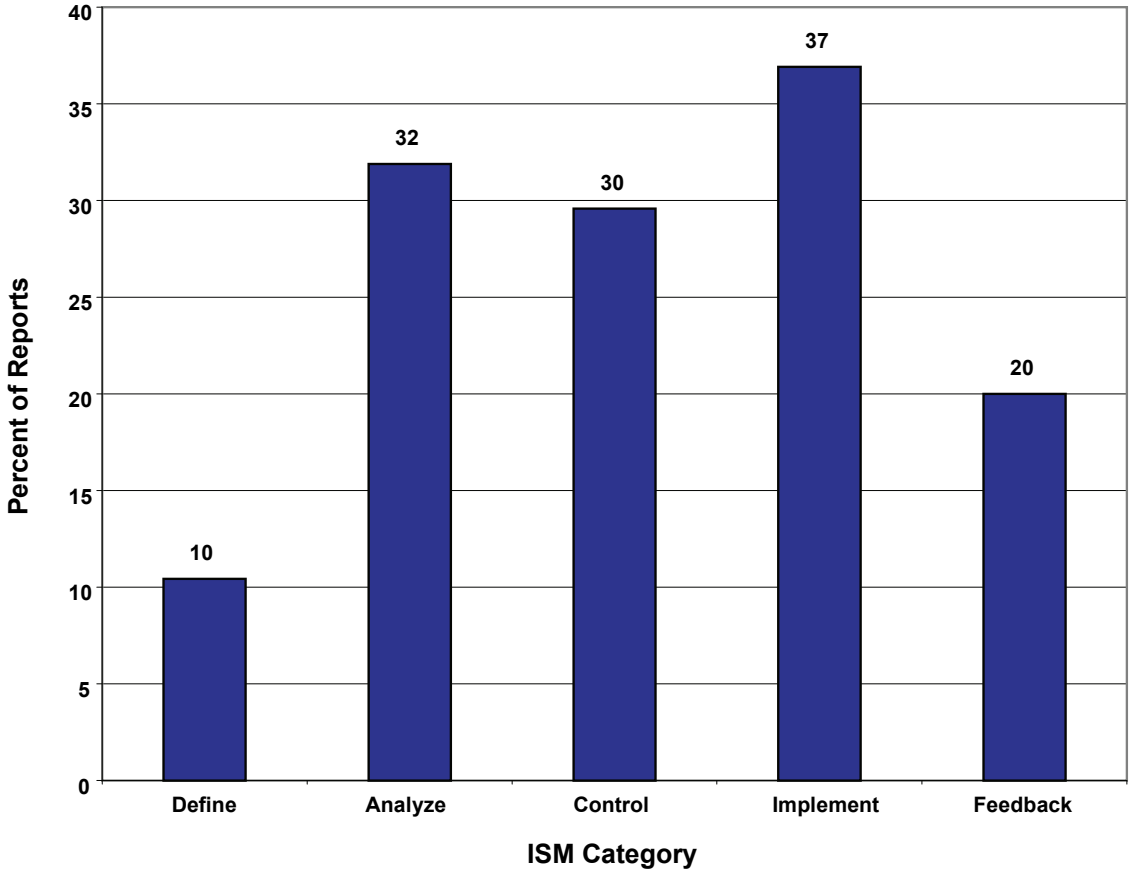

Figure 4. 2007 ORPS ISM Analysis

Oversight reviews of essential systems at nuclear facilities indicate that most are in good material condition. In addition, operators are typically well trained, experienced, and knowledgeable. Sites have improved their unreviewed safety question programs, in part because of improvements in policy and guidance.

However, design engineering for essential systems is an area of significant weakness at most of the evaluated sites. Many of the identified concerns are legacy design problems, but there are also many instances of less than rigorous attention to safety basis and insufficient analysis. The contractor cognizant system engineer program and the DOE safety system oversight programs for nuclear safety systems are also areas of significant weakness, with instances of safety system oversight programs that are not functional. Some aspects of maintenance, such as procurement and configuration management during maintenance, are areas that need improvement at many of the evaluated sites.

As shown in Figure 3B, the Independent Oversight results and ratings for 2007 indicate that, in general, essential system functionality needs improvement. In addition, the figure shows that particular management attention is needed to improve engineering design programs and safety system oversight, including emphasis on increasing the technical capability of contractor organizations and DOE site offices.

Contractor assurance systems are an area of longstanding weakness. DOE Order 226.1 provides a good structure for an effective contractor feedback and improvement program, and some improvements were evident in the 2007 Independent Oversight results. For example, most sites are starting to make better use of work observations to conduct performance-based evaluations. However, there are continued weaknesses in many aspects of contractor assurance systems, including issues management, self-assessments, and injury and illness investigation and reporting. As shown in Figure 3C, the improvements have not yet resulted in effective performance and all contractor programs were rated as Needs Improvement, continuing the trend of recent years.

Most DOE program offices and site offices are making improvements in **line management oversight** in accordance with implementation plans for DOE Order 226.1. However, many of the evaluated DOE program offices and site offices have deficiencies that hinder their ability to adequately identify deficiencies and drive performance improvements in contractor ES&H programs. Some site offices have more mature programs than others, but as shown in Figure 3C, one of the evaluated programs was rated as Significant Weakness, and the others were rated as Needs Improvement. As noted above, there are also deficiencies in DOE site office safety system oversight programs.[4]

DOE Initiatives

DOE and HSS generally have a good understanding of the areas of current weakness. DOE, with HSS serving in a coordinating role, has a number of ongoing initiatives to address them, as shown in the examples below. DOE Headquarters-led initiatives include:

- Issuing and implementing the ISM Manual to better define and institutionalize DOE line and contractor management responsibilities for ISM in important areas, such as evaluations of the effectiveness of ISM implementation.
- Establishing the ISM "Top 10" priorities to identify the issues/areas (e.g., feedback and improvement) that warrant higher priority attention from DOE management and sites as part of the effort to improve ISM.
- Establishing the ISM Champions and Champions Council to promote and sustain improvements in ISM through various mechanisms, such as annual ISM workshops to share lessons learned and best practices.
- Promoting the concept of integrated management (e.g., security and safety interface and interrelationship with ISM).
- Promoting the use of the Voluntary Protection Program to enhance worker involvement in safety and improve the safety culture at DOE sites.
- Developing and tracking additional leading performance metrics for ES&H performance to complement the lagging metrics (e.g., Total Recordable Case and Days Away, Restricted or Transferred rates).
- Enhancing National Training Center training programs in such areas as safety system oversight and development of technical capabilities.

[4] DOE safety system oversight requirements apply only to defense nuclear facilities. Some other DOE organizations chose to implement a formal safety system oversight program, although not mandated by DOE directives.

In addition, DOE program offices, site office, and contractors have ongoing improvement initiatives and/or corrective action implementation plans. For all sites inspected by Independent Oversight in 2007, DOE line management has submitted corrective action plans for the site-specific findings. Important improvement initiatives include development of Headquarters and field organization ISM system descriptions, development and approval of worker safety and health programs in accordance with 10 CFR 851, and establishment of rigorous procedures for delegation of safety authorities. Some key program office-specific improvements include:

- To ensure EM-wide implementation improvements to ISM systems, EM developed a standardized Criteria Review and Approach Document (CRAD) to assess feedback and improvement, work control, and corporate operating experience.

- In 2007, EM established an Office of Standards and Quality Assurance, conducted Nuclear Quality Assurance lead auditor training at multiple sites, established a corporate quality assurance board, and conducted quality assurance audits of new/critical projects to enhance its quality assurance program, which is an integral part of ISM.

- EM Headquarters has implemented DOE Order 226.1, Implementation of Department of Energy Oversight Policy, through enhanced line management oversight of field elements and contractors with a focus on day-to-day operational awareness of safety and operating experience; comprehensive monthly safety trend analysis, issue identification and resolution, and follow-up; frequent independent assessments of the field implementation of various aspects of ISM; and implementation of the EM Corrective Action Management Plan, which resulted in zero overdue corrective actions throughout the year. EM Headquarters has provided guidance to field elements on conducting annual reviews of ISM implementation and making declarations about the effectiveness of ISM implementation.

- NE achieved significant progress in implementing DOE Order 226.1 through its establishment of the NE Safety Management Process. The process includes the Safety Management Functions, Responsibilities and Authorities Document; the ISM system description: the Quality Assurance Program Plan; the NE Safety Management Plan for Risk Based Oversight Standard Operating Procedure; and the training based oversight proficiency process. NE also established an integrated assessment schedule.

- SC made progress toward completion of the SC management system, which is a web-based management tool providing responsibilities, authorities and approaches. The system establishes a hierarchy of documents that translate requirements into common approaches for SC Federal personnel. SC issued a quality assurance and oversight management description and is developing a line management program description to establish SC's approach for implementing DOE Order 226.1.

- NNSA's Chief of Defense Nuclear Safety has conducted rigorous reviews of site office oversight processes. In addition, a rigorous review of Defense Programs was conducted and corrective actions were developed. Defense Programs had also led the development of a rigorous set of criteria and guidelines for reviewing activity-level work planning and control in accordance with ISM and quality assurance principles.

For the most part, these DOE-wide and site-specific initiatives encompass the areas of weakness identified in Sections 3 through 6 of this report. For example, the ISM "Top 10" ISM priorities recognize the importance of improvements in work planning and control, feedback and improvement systems, human performance improvement, safety culture, performance objectives, ISM reviews, and verification of corrective actions;

these improvement areas correlate well with the areas of weakness and opportunities for improvement noted in Sections 3 through 6 of this report (although the initiatives related to some weaknesses in essential system functionality are limited). DOE has made various efforts to address the "Top 10" ISM issues, which are in various stages of development and implementation. As another example, DOE's National Training Center has a number of new courses and ongoing efforts to improve DOE oversight of nuclear safety and essential system functionality, which is another area of weakness discussed in this report. HSS will continue to promote and monitor such initiatives and evaluate their effectiveness through Independent Oversight inspections and other HSS reviews of ISM implementation.

Summary

ISM has proven to be an effective program for driving improvements in ES&H programs at DOE sites. However, much work remains to be accomplished to address areas of weakness. Improvements in contractor assurance systems and DOE oversight (including safety system oversight of nuclear safety systems) are particularly important as they provide the greatest potential for return by improving sites' ability to self-identify and correct deficient conditions. Current DOE initiatives address many of the areas of weakness identified in this report but are in various stages of development and implementation and need continued emphasis by management.

Sections 3 through 6 provide a more detailed discussion of the current status of ISM implementation for the four evaluated ISM elements, based primarily on Independent Oversight results in calendar year 2007. For each section, the discussion begins with an overall assessment and then identifies strengths and best practices, weaknesses, and opportunities for improvement.

3 Work Planning and Control

DOE site work planning and control systems are intended to ensure that work is performed safely and in accordance with site requirements and the core functions of ISM.

3.1 Assessment

Most DOE sites have increased their emphasis on strengthening work control systems, with some commendable improvements. Specific work control system improvements were noted at many of the inspected sites. Some sites have successfully instituted work planning processes in which ES&H professionals or trained and qualified work planners conduct an initial screening of proposed activities to identify hazards and/or the level of risk (e.g., low, moderate, high). These individuals use the initially identifiable unmitigated hazards to rank the hazard and/or risk level of the proposed activity. Based on this initial ranking, the work planning process further requires the involvement and oversight of ES&H subject matter experts (SMEs) during the actual planning and conduct of work. This ES&H SME involvement and the rigor applied in the work planning process are typically based on a graded approach, given the hazard and/or risk ranking level, the known unmitigated hazards, the proposed controls to be utilized, and the complexity of the work.

The Superblock at LLNL is one of the sites that have significantly improved their work control process. The Superblock process is now effective and well-defined, and it systematically categorizes all work and specifies how hazards associated with each work type are to be identified and controlled. In another example, BNL organizations have developed processes that have enhanced several ES&H programs and that, when implemented with sufficient rigor, are effective in defining the scope of work, analyzing hazards, and identifying needed controls. Many research and development organizations have also shown some successes in formalizing experimental review processes to include better hazard analysis of the experiment setup as well as actual experiment performance. Improvements are also evident in several aspects of facility maintenance, operations, or utilities. For example, waste management and cleanup activities at the LLNL 801 complex for post-shot beryllium and low-level radioactive wastes are comprehensive and effective, and they incorporate innovative processes to minimize liquid waste. In a third example, although in the early stages of

A Contained Firing Facility Chamber after an Explosive Test at LLNL

implementation, laboratory instructions and the initial format for INL-MFC Facilities and Site Services preventive maintenance work packages developed under a new work management system are comprehensive and adequately address hazards and controls for observed work.

Many of these improvements are a direct result of managers at all levels and in all organizations demonstrating an increased level of involvement in improving ES&H performance. Observed improvements in work control systems have also resulted from the incorporation of the worker safety and health program into Federal regulations, forcing many sites to establish worker protection components not previously required by their contracts. In February 2006, the health and safety requirements of DOE Order 440.1A were incorporated into 10 CFR 851, *Worker Safety and Health Program*, which became effective in May 2007.

The continued efforts to implement an environmental management system, as required by DOE Order 450.1, *Environmental Protection Program*, also contributed to improved work controls. For all the evaluated sites, Independent Oversight and the responsible DOE site office determined that the site contractor(s) have established institutional environmental management systems that adequately address the DOE Order 450.1 requirements, such as establishing environmental goals and objectives and integrating the environmental management system into the site ISM system. At the institutional level, the environmental management system and programs for addressing significant environmental aspects have had a positive effect on site efforts to ensure compliance with environmental requirements and to protect the environment. At most of the evaluated sites, environmental hazard analyses are performed effectively, and the resulting controls are effectively integrated into work planning and control for research, maintenance, production, new construction, and restoration/demolition. However, some sites have not sufficiently implemented controls and requirements for addressing significant environmental aspects at the facility and activity levels.

While the Independent Oversight inspections identified several positive aspects and best practices, much work remains to fully integrate safety management into contractor work control systems. At several sites, the overall work planning and control programs are not comprehensive enough to ensure that all hazards are systematically evaluated and that appropriate controls are implemented. These deficiencies are most prevalent for work activities where the work control processes allow or direct the work to be planned as routine, low hazard, and within the skill base of the worker, even though the actual work contains a spectrum of hazards requiring more extensive evaluation and control. In other cases, external requirements are not properly identified or correctly reflected in organizational implementing procedures or in sitewide requirements. Additionally, in cases where requirements were adequate, the Independent Oversight inspections identified several weaknesses in supervisors, work planners, and ES&H SMEs following the requirements of the work planning process. The inspections also identified a number of instances where workers did not follow procedures or other ES&H requirements, in some cases with tacit acceptance by supervision or facility/laboratory management. Incomplete identification of institutional standards and safety requirements in working-level documents to be used by the workers, such as those specifying personal protective equipment (PPE) for chemical work, places heavy reliance on the worker, who may not have sufficient training and experience to make a conservative decision. This is a longstanding weakness that has been identified by many Independent Oversight reviews.[5]

In the area of workplace exposure assessments, several sites have not fully implemented the associated regulations even though the basic requirements have been in effect for over 18 years. Although there have been improvements in addressing physical hazards (e.g. electrical safety, hoisting and rigging, pressure safety), such improvements are not as evident with respect to worker exposure to health hazards (e.g. hazardous

[5] See *Independent Oversight Lessons Learned Report: Environment, Safety and Health Evaluations*, July 2004, for further discussion of weaknesses in this area.

chemicals, noise, cryogens, oxygen deficiency, vibration, non-ionizing radiation). The worker exposure assessment and workplace exposure monitoring requirements of 10 CFR 851 and its predecessor, DOE Order 440.1A, have remained basically unchanged since 1988 in that worker exposures to chemical, physical, biological, or ergonomic hazards are to be assessed through an exposure assessment and, as appropriate, workplace monitoring, biological monitoring, and observations. However, several sites lack sufficient procedures, policies, or guidance to implement the workplace exposure and monitoring requirements of 10 CFR 851. At each site, the inspection team noted a number of workplace exposures that had not been identified, analyzed, monitored, and/or documented. None of the sites had completed 10 CFR 851 baseline exposure surveys of all of their work activities, and several sites had already acknowledged this gap in their Worker Safety and Health Plan submittals to DOE. In some cases, the sites lack sufficient industrial hygiene resources to implement an effective workplace exposure assessment program, and in other cases, the results of exposure assessments were not incorporated into work control documents. In addition, work performed by subcontractors often lacks an assessment of worker exposures. Many of the workplace exposure monitoring weaknesses discussed above were previously identified in an Independent Oversight special review report from reviews of eight sites from January 2006 through June 2007.[6]

Overall, the DOE complex continues to show improvement in integrating safety management into work control processes. However, many challenges remain, and the deficiencies cited above warrant increased management emphasis across the complex on improving development and implementation of work control processes and on improving worker compliance with procedures and other ES&H requirements to ensure that workers and the environment are adequately protected from workplace hazards.

3.2 Strengths and Best Practices

The use of a Technical Response Team by CH2M Washington Group, Idaho, LLC for decontamination and decommissioning (D&D) work at the ICP Reactor Technology Center is a notably effective practice for providing real-time support to field supervisors and foremen. The Technical Response Team assists supervisors and foremen in D&D project areas in determining a course of action when a change in work scope is proposed, or when unanticipated work conditions occur. The Technical Response Team includes members from project management, D&D, maintenance, engineering, radiological control, environmental, and industrial hygiene, and it provides real-time involvement and integration of health and safety professionals in situations likely to involve new or changing hazards or controls. The Technical Response Team visits each job site daily, remains on call throughout the day to help resolve emerging work control issues, provides documented guidance, and tracks actions through completion.

Noteworthy workplace exposure assessment record keeping systems have been developed and implemented at NTS and by the contractors at the INL site. 10 CFR 851 requires a record of workplace exposure monitoring observations, testing, and monitoring results. To meet this requirement, a few DOE sites have developed and implemented sophisticated computer-based exposure monitoring and record keeping systems. For example, the Hazard Assessment and Sampling System (HASS) currently in use by the two prime contractors at the INL site was developed to meet the exposure assessment guidance provided by the American Industrial Hygiene Association (AIHA) that is referenced in the DOE guidance documents. The HASS is user-friendly, is robust in its scope and capabilities, and is routinely used by INL industrial hygienists.

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[6] See *Independent Oversight Report on Workplace Exposure Monitoring*, February 2008, for further discussion of weaknesses in this area.

Work Activities at the U1a Complex at NTS

A second noteworthy exposure assessment database is the Defense Occupational & Environmental Health Readiness System (DOEHRS), which was developed in conjunction with the Department of Defense and is used at NTS. The DOEHRS database is also being integrated with a historical worker exposure database that includes over 1 million health hazard employee records for NTS workers and spans the time from the commencement of operations at the site to the present.

BNL has a particularly strong program for inspection of heavy equipment. BNL systematically inspects heavy construction equipment, including cranes, earth-moving equipment, drill rigs, aerial lifts, and rigging, before it is used on site by construction subcontractors. These inspections include an assessment of equipment condition and verification that equipment operators are appropriately trained and qualified. Institutional procedures assign responsibilities and provide direction for these inspections. Construction subcontracts contain a requirement that BNL be notified 48 hours before the equipment is brought on site so that it can be inspected before use.

Most DOE sites maintain onsite accredited laboratories to analyze workplace monitoring samples. 10 CFR 851 requires the "use of accredited and certified" laboratories for analyzing industrial hygiene workplace samples. Most of the evaluated sites maintain onsite analytical laboratories that are accredited by the AIHA in one or more analytical procedures (e.g., metal and solvents). These sites decided to maintain an onsite laboratory analysis capability for two reasons: (1) they need to accommodate a large number of samples (e.g., beryllium or asbestos samples) and/or provide a laboratory response capability in order to support site production activities, and (2) many of the sites must analyze samples that could be radiologically contaminated, and thus cannot be processed at a commercial laboratory. However, in all cases, the onsite laboratory capabilities are augmented with contracts at commercial analytical labs.

3.3 Weaknesses

Most work planning and control programs are not sufficiently comprehensive to ensure that all hazards are systematically evaluated and appropriate controls implemented, particularly for work activities that are considered routine. All sites that were reviewed have documented programs to address work-planning requirements, and improvements were noted. However, the maturity level of these programs varies, and important program weaknesses were noted at most sites, contributing to ineffective hazard analysis and control for observed work activities. Insufficient institutional requirements were noted at most sites, with the most common concern being the grading of hazard levels and a need for the involvement of ES&H professionals in work planning. Institutional requirements in these areas were often incomplete or vague, resulting in workers and supervisors evaluating ES&H hazards and controls at the time of work. These deficiencies were most prevalent for work activities where the work control processes allowed or directed the work to be planned as routine, low hazard, and within the skill base of the worker, even though the actual work contained a spectrum of hazards requiring more extensive evaluation and control.

Several sites have not fully implemented their established work control requirements with sufficient rigor to ensure worker safety and compliance with ES&H requirements. In addition to the work control program deficiencies discussed above, several sites did not adequately implement their established institutional work control requirements for some laboratory, research and development, manufacturing, maintenance, and construction activities. At most of the inspected sites, the required hazards analyses were not performed for some hazards, and some hazard controls, such as PPE, were not identified or were not sufficiently described to allow workers to identify and implement the appropriate control.

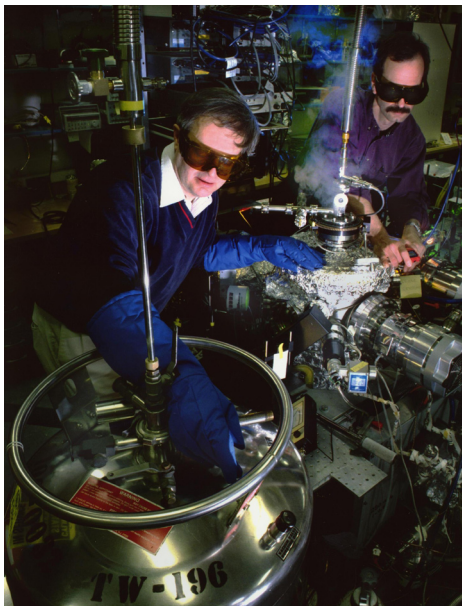
Several sites exhibited some weaknesses in the application and implementation of radiological controls. While most sites have a well-documented, mature radiation protection program, key radiological program elements have not always been implemented as necessary to ensure adequate radiological safety. The most common areas of concern are the use and application of radiological work permits, conduct of radiological surveys, monitoring and contamination control, and aspects of internal dosimetry and bioassay programs. In some cases, these deficiencies resulted from insufficient implementing procedures to ensure proper implementation of program requirements. Lack of adherence or documented equivalency to DOE technical standards or insufficient definition of site-specific requirements and controls contributed to many of these deficiencies, particularly in the area of implementing procedures, radiological work permits, and contamination control. In other cases, adequate mechanisms and procedures were in place but not followed due to a lack of rigor or unfamiliarity with the institutional requirements, indicating weaknesses in conduct of operations and/or training (see further discussion below).

Several sites lack sufficient procedures, policies, or guidance to effectively roll down and implement regulatory or contractual requirements. For example, one site had no policies or procedures for performing workplace exposure assessments or for implementing the workplace monitoring requirements of 10 CFR 851 or DOE Order 440.1A. One laboratory had developed a draft exposure assessment program, but it lacked any details about an exposure monitoring strategy. Two sites, with the approval of the local DOE office, did not incorporate DOE Order 440.1A requirements for workplace monitoring into their contracts until after September 2006, even though the DOE requirements had been in place since May 1998. As a result, policies and procedures for workplace monitoring were only beginning to be developed to meet the requirements of 10 CFR 851 at the time of the Independent Oversight inspections. At a few sites, external requirements were not properly identified or correctly reflected in organizational implementing procedures or in sitewide requirements. Examples include the lack of effective mechanisms within work control processes for addressing external requirements, such as the lockout/tagout or arc flash protection requirements of National Fire Protection Association 70E, *Standard for Electrical Safety in the Workplace*.

At some sites, non-radiological workplace exposures to occupational hazards have not always been sufficiently analyzed and/or documented for some facilities and work activities to meet the initial baseline survey or periodic resurvey requirements of 10 CFR 851. At a number of sites, self-assessments and 10 CFR 851 gap analyses identified that they had not completed comprehensive baseline exposure monitoring as required by 10 CFR 851 and had not self-identified the non-compliances with 10 CFR 851. For these sites, exceptions to 10 CFR 851 have been formally entered into the Non-compliance Tracking System. In some cases, few baseline exposure assessments have been completed. For example, at one site, only about 10 percent of an estimated 800 required exposure assessments had been completed at the time of the Independent Oversight inspection. Further, several sites had not determined the number of exposure assessments that would be needed to meet the baseline survey requirements of 10 CFR 851. At every site that was reviewed, numerous non-radiological exposures lacked an exposure assessment. In some cases, the work control hazard analysis process did not have sufficient "triggers" to ensure that industrial hygienists were sufficiently involved in the assessment of workplace exposures, so workplace exposures were missed.

Other examples indicated that changing work practices and/or changes in the facility or equipment did not trigger a review or update of the exposure assessment. In some cases, line managers did not recognize potential worker exposure hazards and/or did not involve industrial hygiene in the assessment of some potential exposure hazards. The most common workplace exposures that were not sufficiently analyzed and/or documented include:

- Machine shop exposure hazards, including exposures from drilling, sawing, grinding, sand/bead blasting, and welding
- Cutting, machining, and soldering lead
- Legacy hazards from past use of lead, asbestos, beryllium, and mercury; such analysis is needed to determine worker exposures to such hazards when performing routine maintenance in legacy hazard areas
- Exposure hazards associated with work performed by subcontractors
- Exposure hazards associated with "skill-of-the-craft" work activities, which are often deemed as "low hazard" and are not reviewed by industrial hygiene to determine whether an exposure assessment is warranted
- Construction and maintenance exposure hazards, which are typically varied and transient in nature (e.g., noise from cutting or sawing, paint spraying) and are often missed in the exposure assessment program.



Work with Cryogenic Materials

At several sites, managers and supervisors have not sufficiently enforced worker compliance with procedures and requirements. Independent Oversight observed examples of workers at several sites and from a variety of disciplines (operators, researchers, radiation control, maintenance, and industrial hygiene personnel) not following established requirements. Examples included failure to follow procedures and maintenance work instructions, failure to observe postings (such as prohibitions on eating and drinking in laboratories and crossing safety barriers), improper storage of flammable liquids or hazardous chemicals, mismanagement of regulated waste, and violations of other established safety requirements, including requirements for lockout/tagout, chemical handling, and cryogen safety. When site management was informed of these failures to follow requirements, most sites took immediate corrective action to resolve the individual deficiencies. However, at several sites, the number and severity of observed deficiencies rose to the level of findings. Additionally, at some sites, personnel continued to work when hazards and/or controls were known to be inadequately defined. In a few instances, facility managers and supervisors who were aware of the discrepancies between established ES&H controls and actual implementation did not take action to ensure full compliance with the controls. Although isolated cases of failure to follow established controls might be expected from a human performance perspective, the number and significance of these deficiencies, coupled with management's explicit or tacit acceptance of non-conformance to established safety controls in a few cases, warrant increased management emphasis across the complex on compliance with procedures and other ES&H requirements to ensure that workers and the environment are adequately protected from workplace hazards.

3.4 Opportunities for Improvement

HSS Office of Health and Safety

1. **Evaluate options for improving DOE sites' understanding of acceptable ES&H practices in the areas of work planning and control, radiation protection, and industrial safety and hygiene based on existing guidance.** Continue and strengthen efforts to coordinate with EFCOG, ISM Champions, and other interested parties to share lessons learned and effective practices and to promote improvements in work planning and control, radiation protection, and industrial safety and hygiene programs.

DOE Line Management

1. **In accordance with 10 CFR 835, *Occupational Radiation Protection*, and 10 CFR 851, ensure that contractors adequately justify and document the technical bases for their protection measures for exposure hazards.** As part of the review and approval process, ensure that the bases are documented in the radiation protection program required by 10 CFR 835, the worker safety and health program required by 10 CFR 851, and associated subordinate implementing processes and that the resulting protection measures are adequate to ensure that workers are protected from workplace hazards.

2. **Increase the use of structured tools to assess implementation of work control processes at the activity level.** Consider adapting and applying tools that have already been developed, such as the *NNSA Assessment Criteria and Guidelines for Performing Assessments of the Effectiveness of Incorporation of Integrated Safety Management and Quality Assurance Principles Into Activity Level Work Planning and Control at NNSA Sites* and the *Independent Oversight Work Planning and Control Implementation Criteria Review and Approach and Lines of Inquiry*. Consider the use of such tools in assessments by Facility Representatives and other SMEs. Encourage contractors to use the tools to assess the status of work control programs and facilitate improvements.

3. **Ensure that sites increase their emphasis on and the rigor of systematic evaluation of hazards and controls for all work activities, including those considered routine.** Specific actions to consider include:

    - Ensure that requirements for work classification systems at all sites contain objective grading criteria to be applied to all work.

    - Ensure that site classification systems include requirements for ES&H SME involvement in the work planning process, the extent of their involvement, and the documentation requirements for conclusions and recommendations provided by these individuals.

    - For work graded as routine and with stable hazards, ensure that sites evaluate the benefits of developing and using facility- or activity-level safety plans that address commonly performed work activities in each facility, the associated hazards, and the required controls; ensure that workers are trained to such safety plans.

    - Ensure that sites improve the quality of activity-level ES&H documentation of actual controls, including more tailoring to the specific activity, increasing accountability of ES&H documentation approvers to ensure that all hazards are adequately addressed, and avoiding boilerplate statements such as "see MSDS [material safety data sheet]" or "use appropriate PPE."

- For work governed by procedures, ensure that sites identify the hazards and requisite controls in either the procedure or an accompanying activity-level hazard review.
- Ensure that sites establish or increase emphasis on specific hazard controls rather than simply requiring "good practices."
- Ensure that sites verify clear linkage of hazard controls to the hazards they are intended to mitigate.
- Ensure that sites avoid listing hazards by entire class (e.g., chemicals or acids) if only specific conditions (e.g., hydrofluoric acid) exist.

Glovebox at INL-MFC

4. **Ensure that sites establish or increase emphasis on initiatives involving management and peer review of activities, such as behavior based safety, to encourage improved and consistent adherence to procedures and other ES&H requirements.** For laboratories and other research and development environments, ensure that sites consider enhancing the use of principal investigators as senior laboratory stewards with safety awareness responsibilities and increasing peer review of activities during performance. For manufacturing, operations, D&D, and similar process activities, ensure that sites consider such programs as senior supervisory watches, conduct-of-operations mentors, and/or technical response teams.

5. **Ensure that sites develop site-specific policies and procedures that define the mechanisms for performing workplace exposure assessments and monitoring to ensure compliance with 10 CFR 851 requirements.** Ensure that sites consider incorporating the exposure assessment and workplace monitoring principles and practices delineated in 10 CFR 851 guidance documents; establish processes for performing and updating baseline workplace exposures; develop thresholds for conducting and documenting workplace exposures; and develop exposure assessment and monitoring frequencies based on risk.

6. **Ensure that sites improve the effectiveness of the workplace exposure assessment and monitoring program.** Ensure that sites adequately document exposure assessments for all work activities that pose a workplace exposure hazard; establish appropriate monitoring of workplace exposures for those work activities that are frequently excluded from such monitoring, such as machine shops, facility work in areas with known legacy hazards, work performed by subcontractors, and "skill-of-the-craft" work activities; and provide sufficient documented technical bases in each workplace exposure assessment to justify exposure monitoring decisions, sufficient to allow a third-party industrial hygienist to reach similar conclusions.

4 Essential System Functionality

For the purpose of this report, essential systems include safety-class, safety-significant, and other defense-in-depth systems (such as fire protection, ventilation, and emergency power and associated support or interfacing systems) that are intended to prevent or mitigate the release of hazardous materials. Essential systems at DOE nuclear sites must function in both normal and accident conditions to ensure the safety of the public, workers, and the environment.

4.1 Assessment

Essential system functionality is a longstanding area of weakness across DOE.[7] Several key areas that were identified in Independent Oversight status reports from reviews of ten sites during 2004 and 2005 as requiring increased management attention include: (1) progress in establishment of basic elements of contractor cognizant system engineer and DOE site office safety system oversight programs; (2) the degree of rigor, level of technical justification, and attention to detail applied by contractors and DOE site offices in the design and review of safety systems; and (3) the level of rigor applied by contractors in implementing configuration management requirements to ensure that safety systems will continue to be capable of performing their safety functions. Although improvements have been made in some areas and a number of promising initiatives are under way, all of the sites that were evaluated in calendar year 2007 had similar weaknesses in various aspects of essential system functionality, as discussed below.

The safety systems at DOE nuclear facilities are typically designed with a substantial margin of safety and/or safety features to withstand challenges. However, most of those systems were designed many years ago and often are not designed to meet current standards, do not have an adequate evaluation and technical basis, or otherwise do not meet the expectations for the rigor of a documented safety analysis, as required by 10 CFR 830. Some sites have made progress in enhancing engineering design functions and upgrading their safety bases, and most sites have ongoing initiatives to enhance their design engineering processes and safety bases. For example, one site has a major ongoing program to enhance conduct of engineering and maintenance and to upgrade the safety bases for all its nuclear facilities and systems. However, weaknesses in engineering design, authorization basis, and configuration management were evident at all of the evaluated sites and warrant priority attention across DOE. In many cases, sites did not have adequate supporting analyses with defensible assumptions to demonstrate that the safety systems could perform their required design safety function, as credited in the design basis accident analyses. In addition, site safety bases or the designs of reviewed safety systems were not completely and/or correctly translated into facility technical

[7] See Independent Oversight reports on *Essential System Functionality*, January 2006, and *Safety System Oversight*, March 2006, for further discussion of longstanding weaknesses in these areas.

Decontamination and Waste Treatment Facility at LLNL

safety requirements and implementing procedures. Because of such weaknesses, sites could not always adequately ensure that systems would function as designed in accident conditions, such as those involving a seismic event or fire.

In the area of maintenance and procurement, the evaluated DOE sites have a number of positive aspects. Equipment is in good material condition, and maintenance backlogs for safety systems are minimal. However, all of the evaluated sites had weaknesses in their maintenance programs that warrant timely improvement in such areas as maintenance implementation plans, procurement practices, and trending of safety system performance, reliability, and maintenance information.

In the areas of surveillance testing and operations, most sites have knowledgeable and experienced operators and effective systems for tracking testing and surveillance activities to ensure that they are performed on schedule. However, overall site performance is mixed in the areas of surveillance testing and operations. Some sites have generally effective programs with few deficiencies; these sites have typically devoted significant attention to enhancing testing and operations procedures. Other sites need to improve surveillance testing and operations, with a particular focus on ensuring the adequacy of surveillance testing procedures and the integration of operations with other nuclear safety programs, such as the safety basis and cognizant system engineer programs.

Many of the deficient conditions cited above can be attributed to a lack of questioning attitude in reviewing and evaluating the engineering design and safety basis of essential systems and/or other deficiencies in feedback and improvement processes. In recent years, DOE has attempted to improve feedback and improvement processes for nuclear safety systems by establishing two complementary programs that specifically focus on nuclear safety systems. Specifically, contractors are now required to have a cognizant system engineer program to perform detailed evaluations of system status and trends for all safety systems, and DOE site offices must implement a safety system oversight program to evaluate safety systems and contractor performance in managing nuclear facility safety. While these programs are an appropriate measure for improving nuclear safety at DOE sites, the expected benefits have not yet been fully realized. The cognizant system engineer programs at the evaluated sites are improving but do not yet fully meet DOE requirements for nuclear facilities. In addition, site office safety system oversight was inadequate at all but one of the sites reviewed in calendar year 2007, and performance at some site offices has degraded in the past few years. Some of the weaknesses in these programs result from insufficient management attention and priority and insufficient application of technical resources and expertise to the programs.

DOE facilities continue to struggle with adequately implementing the safety system review and oversight requirements for nuclear facilities. The contractor cognizant system engineer and DOE safety system oversight programs have not yet driven the needed improvement in this area and have not always received the needed attention. Significant DOE and contractor attention is needed to drive long-term improvements in essential system functionality.

4.2 Strengths and Best Practices

Most safety systems are in good material condition and are tested in accordance with technical surveillance requirements. At the sites reviewed in 2007, the safety systems that were reviewed are in good material condition. Maintenance backlogs are minimal, and facility management and staff are diligent in ensuring that maintenance on safety systems is appropriately prioritized and preventive maintenance is conducted when scheduled. Technical surveillances are performed at the required interval and are appropriately tracked. All evaluated sites have established effective processes and mechanisms that generally ensure that safety system surveillances are conducted in accordance with technical surveillance requirements. Most technical surveillances that were observed were completed in a rigorous manner, and records were available to demonstrate that safety systems were operable.

The Nevada Site Office's oversight of vital safety systems at the Device Assembly Facility is promoting improvements in nuclear safety programs. The Nevada Site Office has conducted a number of assessments of vital safety systems and safety management programs at the Device Assembly Facility. These assessments were rigorous and performance-based; although a few deficiencies were missed, the assessments identified a number of concerns and resulted in significant corrective actions and a good understanding of the status of nuclear safety systems. The assessments also provided valuable feedback to aid the contractor in focusing improvement initiatives to further strengthen the contractor's cognizant system engineer program and its effectiveness in monitoring and ensuring vital safety system performance. Features of the program that contribute to its success include effective processes for coordination between personnel with safety system oversight responsibilities and safety basis analysts and the use of an experienced nuclear safety advisor to oversee the program and mentor personnel. The Nevada Site Office Safety Basis Review Team's review of the contractor's 2006 annual documented safety analysis update and recent vital safety system reviews were particularly noteworthy and effective in identifying issues and concerns in the areas of engineering design and authorization basis.

4.3 Weaknesses

DOE and site contractors have not ensured an appropriate degree of rigor, level of technical justification, and attention to detail in the design and review of safety systems. Most (three of four) evaluated sites had significant weaknesses related to the adequacy of the technical basis for the engineering design and surveillance testing of the selected safety systems. For example, safety system designs did not completely and/or correctly reflect the performance requirements of the facility safety bases; as a result, the system's ability to fully perform its credited safety functions is not adequately assured. In addition, the safety bases or the actual designs often were not completely and/or correctly translated into facility technical safety requirements, procedures, and practices. Further, in many cases, the documentation and analyses that demonstrate the ability of safety structures, systems, and components to perform their safety functions or that provide a basis for administrative controls did not exist, were not reasonably accessible, and/or were not controlled in a manner to ensure dependable routine use in facility operations. These deficiencies reflect inadequacies in the site contractor's design, safety analysis, and cognizant system engineer programs, as well as deficiencies in DOE safety system oversight and DOE reviews of contractor safety analysis submittals.

Weaknesses in configuration management programs, maintenance programs, surveillance procedures, and operations reduce the assurance in safety system operability. Configuration management programs are not always implemented with sufficient rigor and attention to detail. For example, temporary modifications

are not always adequately addressed, labeling of equipment is not always adequate, and software quality assurance requirements are not always sufficiently defined and implemented. The DOE site contractors that were evaluated have not established formal programs for tracking and trending equipment performance. Although maintenance of safety systems is generally defined and performed, none of the sites reviewed in 2007 had adequate formal processes for tracking and trending maintenance information, and methods and mechanisms for documenting and retrieving completed maintenance work were not sufficient to support performance trending (e.g., maintenance history not captured and maintained in a system that permits timely retrieval). In some cases, sites do not have adequate maintenance implementation plans, and/or procurement processes are not sufficiently rigorous to ensure that replacement parts meet specifications. At some sites, surveillance procedures are not fully consistent with technical safety requirements or do not include sufficient provisions to ensure that performance capabilities are fully demonstrated and verified. For example, there were weaknesses in such areas as independent verification, alarm response procedures, and normal system valve and component lineups. Independent Oversight team observations and reviews also indicated that some personnel had inadequate knowledge of institutional procedures and programs, such as the problem identification and resolution programs and the implementation of operability evaluations.

Site corrective action programs have not been implemented with sufficient rigor to address previously-identified deficiencies in safety systems. Independent Oversight inspections selectively examined the adequacy of site programs to resolve previously-identified deficient conditions. In several instances, previously-identified deficiencies were not adequately corrected in such areas as safety system configuration management, design, and authorization bases. In these cases, corrective action plans had not been developed or were insufficient, and compensatory measures were not in place. As a result, safety systems remained in a degraded condition for long periods, and there was an increased risk that the safety systems would not perform as required during accident conditions.

Contractor cognizant system engineer programs do not fully meet established requirements. Most of the evaluated contractors have established the basic elements of cognizant system engineering programs but are not fully compliant with the requirements defined in DOE Order 420.1B, *Facility Safety*. Most programs are in various stages of implementation, and none are mature (e.g., they lack adequate procedures and review criteria). In addition, the system engineering processes do not ensure effective coordination with safety basis, configuration management, maintenance, and surveillance and testing programs. Many system engineer responsibilities and functions have not been adequately defined and fully implemented in such areas as performing system assessments, performing periodic system reviews and walkdowns, trending system performance, evaluating system reliability and maintainability, preparing system health reports, maintaining master equipment lists, maintaining records, and assessing the need for alternative preventive maintenance activities. For example, the one site that has over 50 vital safety systems had a requirement for only one vital system assessment per year. Cognizant system engineer program staffing is not always adequate to cover the number of facilities and systems, and cognizant system engineers are often assigned too many collateral duties to effectively monitor and evaluate their assigned safety systems' operability, reliability, performance, and material condition. In some cases, assessments and reviews have not been performed in accordance with established schedules, and no site has established adequate processes for formal systematic analysis and/or trending of information from walkdowns, surveillances, in-service inspections, and maintenance (corrective, preventive, and predictive). Further, training and qualification programs for system engineers are not adequate (e.g., insufficient training on key responsibilities such as system assessments and trending key parameters, insufficient verification of engineering expertise and knowledge of applicable standards and codes), and not all cognizant system engineers have completed the required qualification programs.

There are significant weaknesses in some DOE site offices' safety system oversight programs for essential systems at nuclear facilities. Although oversight of nuclear safety through a safety system oversight

program is one of the most important functions of a site office, the performance of DOE site offices in this area varies considerably. Of the site offices that were reviewed in 2007, only one had an adequate program for oversight of nuclear safety systems. At some site offices, safety system oversight has degraded in the past few years and was determined to be significantly deficient. In addition, although the requirements had been in place for several years, some site offices were just beginning to implement a safety system oversight program. Some personnel performing safety system oversight responsibilities were not yet fully qualified, and many had too many collateral duties to be effective in their safety system oversight role. Some site offices perform very little safety system oversight of nuclear facilities in important areas, such as engineering design, authorization basis, configuration management, and safety system performance. In other cases, assessments are not always performed with sufficient depth and rigor to identify design and safety basis issues. In addition, site offices are often not sufficiently involved in reviewing the completion of contractor actions to correct identified issues in technical safety system engineering and the safety basis. Further, site offices often do not adequately review site submittals, so they have often approved contractor documents (e.g., maintenance implementation plans) that were inadequate. Sites that have inadequate site office safety system oversight programs have not been effective in self-identifying and addressing deficiencies in site nuclear safety system safety bases, implementation of technical safety requirements, engineering, configuration management, operations, and system engineering programs. Conversely, effective site office safety system oversight has led to self-identifying deficiencies and improvements in contractor nuclear safety programs.

4.4 Opportunities for Improvement

HSS Office of Nuclear Safety and Environment

1. **Establish a Departmental standard for the DOE safety system oversight program.** Consider applying the model used for the DOE Facility Representative program to safety system oversight, building on or extending the tools and processes (e.g., staffing guidance, program standard, program performance indicators) already in place to monitor and support the health of such a program.

2. **Evaluate the benefits of applying safety system oversight programs to non-defense nuclear facilities.**

3. **Revise the safety system oversight program documents to strengthen oversight of system design and the safety basis.**

DOE Line Management

1. **Strengthen site office oversight of the quality of contractor engineering programs and products.** Ensure that safety system oversight engineers are sufficiently involved in nuclear facility upgrades and modifications and the associated safety basis review activities. Conduct focused assessments of the effectiveness of the contractor's quality assurance processes (including independent review) for design calculations. As part of vital safety system assessments, increase the focus on and attention to contractor design products, evaluating the degree of rigor, level of technical justification, and attention to detail in safety system design. For new safety systems and modifications of existing safety systems, perform selected independent reviews of design documents, including assessment of supporting calculations to determine the effectiveness of the contractor's quality assurance processes for engineering design.

2. **Ensure that site contractors strengthen the rigor, level of justification, and attention to detail in the design and review of safety systems.** Ensure that contractor engineering procedures are established

for performing and documenting calculations, including independent verification. Strengthen quality checks on the adequacy of technical products by requiring system engineers to perform detailed reviews of assigned safety systems, including review of all supporting calculations. Review safety analyses for all statements of performance capabilities of safety systems, structures, and components. Verify that all performance and functional requirement statements are supported by analyses and, where appropriate, testing. Verify that analyses and testing adequately demonstrate the performance and functional requirements contained within the safety analysis.

3. **Ensure that contractors enhance their maintenance history records to better support performance trending, life cycle management, and preventive, predictive, and corrective maintenance procedure development and improvement.** Establish and enforce management expectations for maintenance work package post-job debriefing documentation to include a description of the as-found conditions, the apparent cause of the problem creating the need for adjustment or repair, the repair or adjustment accomplished, and the as-left conditions. Add data fields to work package forms as necessary to record these items to support automated trending and sorting.

4. **Ensure that cognizant system engineers are adequately trained and held responsible for the full scope of their roles and responsibilities, authorities, and accountabilities as defined in facility and institutional procedures.** Ensure that the requirements of DOE Order 420.1B (e.g., trending, system health report, operability, reliability, performance, and material condition) are addressed. Ensure that contractors, as necessary, consider:

    - Evaluating roles and responsibilities to ensure that system engineers are not assigned collateral duties that prevent them from accomplishing cognizant system engineer program duties.

    - Developing a cognizant system engineer desk guide to clearly establish and communicate management expectations for system trending and self-assessments, addressing the frequency of performance, report format and content, grading criteria, and other such provisions.

    - Evaluating training and qualification programs and, as necessary, adding provisions for training on the various topics essential to performing system engineer duties, with a particular focus on knowledge of codes and standards specifically applicable to the design, operation, and maintenance of the safety system(s) assigned.

5 Contractor Assurance Systems

Site contractors must establish a comprehensive contractor assurance system, which is an essential element of ISM and provides feedback and information that is to be used to identify and correct deficiencies and continuously improve ES&H programs.

5.1 Assessment

Based on 2007 Independent Oversight inspections, contractor assurance systems are improving as contractors implement and refine their approaches for meeting DOE Order 226.1, *Implementation of DOE Oversight Policy*. With some exceptions, the contractors that were reviewed have established and implemented the safety assurance elements defined in DOE Order 226.1, and these elements are contributing to safer conditions and improved work performance and environmental protection. Worker feedback is solicited, assessment activities are performed, injuries and events are analyzed and reported, issues are identified, employee concerns are investigated, deficiencies are corrected, and lessons learned are identified and applied. Some contractors have established and implemented new processes or initiatives that have been effective in improving safety performance, such as issues management review boards and worker-managed safety and work observation programs.

However, process weaknesses and inadequate implementation persist in each of the assurance system elements that were reviewed. The effectiveness of assurance systems in driving substantial and continuous improvement in ES&H performance is often limited by insufficiently and inconsistently defined requirements and processes and insufficient rigor and oversight of their implementation. Often, contractors do not conduct sufficiently rigorous self-assessments of appropriate processes and activities based on a structured planning process. Safety issues are often not accurately analyzed for causes and extent of condition, and action plans too often do not provide effective recurrence controls. As discussed in Section 4, contractor cognizant engineer programs, which are an important feedback and improvement element, are not yet consistently effective, although several sites are improving their programs. Also as discussed in Section 6, DOE site office oversight programs have not been sufficiently effective to consistently identify deficiencies and drive improvements in contractor assurance systems.

An area of particular concern is the lack of rigorously performed and documented investigations and management of occupational injuries and illnesses, especially for less serious, non-reportable first aid cases that often reflect deficiencies in ISM principles and work control and do not meet reporting requirements only because of the severity level. The identification, evaluation, and application of operating experience and lessons learned often cannot be demonstrated due to process weaknesses and lack of documentation. Weaknesses were identified in the rigor applied to investigating lower ORPS Significance Category

events and in the trending of incidents and events below the reporting thresholds as required by DOE directives. The conduct and documentation of fact-findings and critiques are often insufficient to facilitate and demonstrate effective analysis and implementation of recurrence controls. Both informal and formal programs for addressing employee concerns lack sufficient rigor in investigating all elements of concerns and in justifying and documenting resolutions. Records and communications with concerned individuals are often insufficient.

There are several common weaknesses underlying contractor assurance system process and performance deficiencies. In most cases, formal controls and mechanisms that are intended to ensure robust, well implemented processes are absent or ineffectively applied. Formal documentation and reporting of the details of activities and actions taken while performing assurance systems functions, with documented review and approval by management, are often insufficiently used to promote accountability for performance. Contractor assurance system administrators often do not perform sufficiently rigorous assessment and routine monitoring of implementation or provide performance feedback to process users and senior management. Effective metrics are seldom employed to provide continuing and/or periodic performance data to system administrators and management. Senior management is not always sufficiently engaged in monitoring performance and in holding managers and workers accountable for effective programs and compliant implementation. Addressing these management and oversight weaknesses would significantly improve the effectiveness of contractor assurance systems in driving continuous safety improvement. A number of the weaknesses discussed above are longstanding and were identified in Independent Oversight site-specific reports and lessons-learned reports dating back to 2003.[8]

Some of the key elements of an effective assurance system that result in continuously improved safety performance are: clearly defined and rigorous requirements documents, rigorous monitoring and oversight of implementation, and engagement by management at all levels in communicating expectations and holding personnel and organizations accountable for compliant and effective implementation. Significant improvement in the quality and effectiveness of contractor assurance systems could be achieved by incorporating stronger requirements and expectations into process documents; by incorporating mechanisms and controls for effective and timely monitoring of the implementation of assurance systems; and by strengthening accountability for performance and management oversight of program effectiveness. In a few cases, DOE directives could be clarified and enhanced to improve the performance and effectiveness of contractor assurance systems in the areas of lessons learned and expectations for investigation and analysis of events.

5.2 Strengths and Best Practices

Some contractors have increased worker involvement to improve feedback systems. Some contractors have initiated the use of human performance improvement concepts and techniques in the analysis of issues and investigation of operational events and injuries and illnesses; such efforts have been effective in focusing preventive actions on institutional deficiencies rather than punishment of individuals. Some contractors have established worker-managed programs, such as employee safety teams and behavior-based safety observation programs, that have been effective in creating safer work environments and improving safe work practices.

[8] See *Independent Oversight Lessons Learned Report: Environment, Safety and Health Evaluations*, March 2003, and *Independent Oversight Lessons Learned Report: Environment, Safety and Health Evaluations*, July 2004, for further discussion of weaknesses and opportunities for improvement in these areas.

Glovebox Work in the Superblock at LLNL

BNL used a structured project management approach to manage the corrective action plans for complex issues or for situations where multiple significant issues were being addressed. To manage the large number and variety of corrective actions and initiatives resulting from a focused review of ISM implementation and previous ISM assessments, BNL management assigned an integrated project team and project manager and effectively applied project management tools to manage the response. A work breakdown structure was developed and updated regularly, a safety improvement project plan was developed, and regular status briefings were provided to contractor management and to DOE. This approach ensured continued management focus on timely development and implementation of corrective and preventive actions.

LLNL has established an effective, comprehensive, and structured program of annual team assessments of ISM implementation consisting of rigorous evaluations of work control documentation and observations of work activities and conditions. This assessment initiative was applied to all site organizations and included sampling of documentation and direct involvement by senior managers in assessing work in progress and communicating, to workers, management's expectations for compliance with work controls. This mandatory, structured, well-defined process resulted in significant improvement in work control documents and the identification of numerous deficiencies, systemic issues, and opportunities to improve work control documents and worker performance.

LANL has established some well-designed and effective processes for enhancing some aspects of contractor assurance system elements and ES&H performance. Management review boards were established in each major organization and at the institutional level as a means for managers at all levels to engage and influence the evaluation and management of safety issues and to better communicate performance expectations to staff. These boards review assessment results and make or concur with classification decisions and corrective action plans, strengthening both the assessment programs and issues management. The LANL contractor is also establishing a robust and comprehensive metrics system. This multilayered, structured, tightly controlled, well-designed "visual dashboard" set of metrics, with clearly defined criteria with supporting analysis and basis text, provides a valuable and effective management tool for performance measurement and monitoring. The metrics and underlying criteria are subjected to continuing refinement and strengthening under the oversight of a dedicated program manager who also provides oversight and feedback on the quality and accuracy of the supporting analyses and ratings.

5.3 Weaknesses

Contractors do not always plan and schedule assessments in a structured, formal, risk-based manner that addresses all processes, activities, facilities, organizations, and programs with consideration of past performance and regulatory requirements. As a result, needed assessments have not been performed for some safety areas or for topics mandated by external requirements from the Occupational Safety and Health Administration (OSHA) and DOE regulations and directives. Assessments are often not sufficiently rigorous to provide maximum value. Weaknesses include insufficiently defined or too limited acceptance criteria and scopes and poor documentation of results and the basis for conclusions. Too little focus has been placed on observation of work and evaluation of records that demonstrate compliance and effective implementation. The quality of assessment planning and performance is seldom adequately monitored by process administrators or SMEs to provide feedback to performers or management. Assessments are often

not reviewed or approved by an appropriate level of management. Management observations are often insufficiently structured and rigorous and not well documented. Results of management observations are often insufficiently managed.

There are continuing weaknesses in contractors' programs for managing safety issues. Problems include insufficiently concise and accurate issue descriptions, inappropriate risk/significance categorization, missing or inaccurate causal analyses and determinations of extent of condition, action plans that do not address all causes or provide sufficient recurrence controls, untimely entry of safety issues into management programs, and untimely resolution of issues. Issues management processes do not include sufficient mechanisms for SMEs and independent parties to provide timely monitoring and assessment of the quality of implementation.

Continuing weaknesses in occupational injury and illness investigation and reporting are evident at most sites. These weaknesses affect key safety performance measures and result in situations where sites miss opportunities to address unsafe conditions or work practices, or where they provide inadequate documents or supervision following actual worker injuries and exposures. Continuing weaknesses include a lack of rigor in the investigation and causal analysis of events in which deficiencies in work control and other ISM elements contributed to the incident. Documentation of investigations, corrective/preventive actions, medical treatment, and restrictions is often insufficient. OSHA categorizations for reportability and days away and restricted are not always correct, and reporting to DOE is not always timely. The rigor of and attention to evaluating and addressing first aid cases, which are not required to be reported to the Computerized Accident/Incident Reporting System (CAIRS) but still involve injury and exposure of workers, are often limited. Often the severity and reportability of first aid cases are not adequately analyzed, events are not sufficiently evaluated as potential precursors for more serious injuries, and investigations do not identify conditions and practices that could have been avoided with better application of ISM principles and core functions.

Several contractors have taken non-conservative approaches to investigation and reporting of lower significance classification events. Although the DOE directive does not require reporting of causal analysis or lessons learned for Significance Category 4 occurrences or root cause analysis except for emergencies, analysis and management of Significance Category 1 or R occurrences are still required. However, some contractors have not performed causal analysis or conducted fact-findings/critiques for these events. Several contractors failed to include sub-reporting threshold events in their quarterly analyses as required by the DOE directive.

Contractor lessons-learned, employee concerns, and activity-level feedback programs have not been implemented with sufficient rigor and attention to detail. Contractors are not consistently effective in rigorously identifying and evaluating operating experience and events to identify lessons learned and do not always effectively communicate and apply lessons learned to prevent recurrences. Several contractors have not used the DOE listserver to share internal lessons learned with other organizations in the DOE complex. Weaknesses in employee concerns programs typically involved insufficient rigor in the conduct of investigations (e.g., not addressing all elements of a concern); untimely resolutions; insufficient documentation of concern details, investigation details, and bases for results; and inadequate communication with the concerned individuals. Although most work control procedures specify some form of post-job review or solicit feedback from workers and supervisors, in practice little feedback is recorded, and the evaluation and application of lessons from this feedback have not been well documented or demonstrated. Feedback from workers is typically informal (e.g., provided at safety meetings and pre-job briefings); more formal feedback is typically provided only at fact-findings and critiques after injuries and operational events.

5.4 Opportunities for Improvement

HSS Office of Corporate Safety Analysis

1. **Clarify and enhance several DOE directives to improve the performance and effectiveness of contractor assurance systems.** Specific actions to consider include clarifying expectations for investigation and analysis of events in accordance with DOE Manual 231.1-2 and strengthening the formality and documentation of contractor elements in accordance with DOE Order 210.2, *DOE Corporate Operating Experience Program*.

DOE Line Management

1. **Ensure that site contractors strengthen their assurance system processes by incorporating requirements and management expectations for quality and effective implementation into procedures and unambiguously communicating them to implementers.** Ensure that site procedures for injury and illness and employee concerns clearly specify the requirements for the scope and method for performing and documenting investigations and for managing any resulting corrective or preventive actions. Ensure that site requirements for documenting actions taken in response to lessons learned and employee concerns are evaluated and improved as needed to provide sufficient rigor.

2. **Ensure that site contractors further strengthen their assurance system procedures by incorporating controls and monitoring mechanisms that ensure routine and timely evaluations to determine whether expectations are being met and requirements are being implemented in a compliant and effective manner.** Ensure that such site mechanisms as quality reviews of assessment plans and reports, employee concerns, and injury and illness investigations, conducted by process administrators or SMEs, are implemented as designed and provide timely performance data to management. Ensure that sites consider the use of issues management review boards to monitor and ensure effective implementation of corrective action programs. Ensure that sites consider the use of project management concepts and tools to manage corrective action plans for significant or complex issues.

3. **Ensure that site contractors integrate mechanisms into their assurance system processes to foster greater engagement of management in monitoring and oversight of performance.** Participation in review boards and routine observations of work conditions and activities by all levels of management has been shown to be effective when rigorously applied. Development of meaningful, consistent, well supported metrics for safety performance and implementation of assurance systems can provide management with data needed to focus attention and resources. Routine presentation of process status and performance evaluations by process administrators, SMEs, and subordinate managers to senior management fosters accountability for compliant and effective performance.

6 DOE Line Management Oversight

DOE line management (i.e., program offices and site offices) must review and evaluate contractor ES&H programs to determine their adequacy and must ensure that deficient conditions are corrected.

6.1 Assessment

The programs and site offices that were evaluated in 2007 are NNSA, SC, and NE. (EM was not reviewed in 2007, although Independent Oversight examined one of its activities.) Some aspects of DOE program office oversight are adequate, and others are improving. Program offices generally have effective mechanisms, such as regular conference calls, for maintaining operational awareness and communications with the site offices. There were several examples of program office personnel taking the initiative to monitor specific issues at site offices, and their resolution. The NNSA Chief, Defense Nuclear Security (CDNS) performed significant evaluations of site office performance in the area of nuclear safety. Also, some program offices have devoted particular attention to monitoring certain aspects of ES&H programs, such as injury and illness rates.

However, the evaluated program offices have some weaknesses in the implementation of their oversight responsibilities. None of the program offices have fully addressed all of the requirements of DOE Order 226.1. For example, some program offices do not have adequate issues management systems, contributing to a failure to resolve deficiencies. There are also weaknesses in such areas as technical qualification programs, lessons learned, self-assessments, and assessment schedules. For example, some program offices did not have complete, integrated assessment schedules. In addition, with some exceptions, program offices have not always been proactive in providing direction to site offices to ensure that important safety concerns are evaluated and in assisting site offices in resolving longstanding and well recognized concerns that have impacted the effectiveness of site office oversight. Although further improvement is needed, two of the three evaluated program offices (SC and NE) had viable programs and implementation plans for improving Headquarters processes; NNSA, aside from the CDNS, did not have adequate plans to address gaps in their responsibilities in important areas, such as issues management. SC was facilitating the establishment of common processes where appropriate for oversight functions.

All of the site offices that were evaluated have structured oversight programs that provide valuable feedback to DOE line management about site ES&H performance. Most of the evaluated site offices have a functional Facility Representative program and perform assessments of various ES&H disciplines. Most site offices also have ongoing initiatives to improve their processes and oversight programs, such as development or enhancement of oversight procedures. Some sites are in the process of adopting automated tools to facilitate issues management and action tracking. Sites have structured processes for evaluating contractual performance against the defined performance objectives and metrics. In addition, some specific elements of DOE site

office oversight are particularly effective and could provide a model for other DOE sites to evaluate and adapt to their own needs. As examples, the Nevada Site Office has implemented an effective process for safety system oversight, the Idaho Operations Office has an effective Facility Representative program, the Livermore Site Office has effectively applied oversight programs to biological research activities, and the Brookhaven Site Office has sustained an effective Facility Representative program.

However, DOE site office oversight needs improvement at all of the evaluated sites in the areas of assessments, issues management, lessons learned, training, qualifications, self-assessments, processes, and procedures. For example, some assessments were missed, including assessments that are required by a regulation or directive, and many assessments did not include adequate assessments of performance. In addition, deficiencies in issues management programs and the communication of findings to contractors have contributed to a situation in which deficiencies in contractor ES&H programs were identified by site office assessments or Facility Representatives but were not always addressed or were not evaluated for extent of condition. Site offices have generally not been fully effective in driving timely improvements in ISM elements, including implementation of the core functions at the activity level, and contractor assurance systems. Weaknesses in safety system oversight programs are a particular concern. These programs are intended to provide assurance that site nuclear facilities are operated safely and thus are a particularly important element of site office oversight. As discussed in Section 4, one site office had an effective safety system oversight program, but there were deficiencies at another site that warrant prompt corrective action.

The reasons for continuing deficiencies are complex and vary across the site offices. In some cases, site offices have gaps or shortages in specific technical disciplines (e.g., industrial hygiene, nuclear engineering design). In some cases, site offices devote significant oversight resources in reaction to specific accidents or events but do not have a strategic approach for defining oversight priorities and focusing oversight resources on those priorities. For example, while there are longstanding deficiencies in contractor work planning and control and assurance systems,[9] the site offices that were reviewed have not yet adequately tailored their oversight to drive timely improvements in these areas. In addition, the program or site offices that were evaluated have not yet established useful criteria for evaluating the effectiveness of contractor assurance systems. In some cases, site offices and program offices have a good understanding of the weaknesses in their programs and viable implementation plans for improving their oversight programs. However, a few do not have adequate plans, and one site office has no viable plan for addressing a significantly deficient oversight program.

A contributing factor is that some Federal personnel who perform oversight do not consistently demonstrate adequate expertise in some important areas, such as contract management, issues management, assessment techniques, data analysis, performance metrics, critiques, investigations, and lessons learned. DOE Order 226.1 requires training for Federal oversight personnel in these areas. The Federal Technical Capability Program provides standards for technical competencies for DOE oversight personnel. The Senior Technical Safety Manager qualification standard establishes competencies in fundamental oversight areas (e.g., contract management, issues management, assessment techniques, data analysis, performance metrics, critiques, investigations, and lessons learned) for managers. However, implementation of activities in these areas is typically delegated to technical SMEs, resulting in a gap in the technical qualification program.

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[9] See *Independent Oversight Lessons Learned Report: Environment, Safety and Health Evaluations*, March 2003, and *Independent Oversight Lessons Learned Report: Environment, Safety and Health Evaluations*, July 2004, for further discussion of weaknesses and opportunities for improvement in these areas.

6.2 Strengths and Best Practices

The Idaho Operations Office has an effective, mature, and well managed Facility Representative program. The Facility Representative program at the Idaho Operations Office has strong personnel performance plans that provide clear management expectations and a detailed plan that provides clear expectations for Facility Representative oversight activities and ensures good coverage of functional areas. Cross-training and rotation of Facility Representatives periodically from one facility assignment to another are effective practices. Facility Representatives' reporting and monthly and quarterly safety documents and tools are effective in communicating issues, observations, and trends to senior managers at the Idaho Operations Office and NE. Facility Representatives' assessments, surveillances, and operational awareness entries are of high quality and rigor. Issues are identified and formally communicated to the contractor, and Facility Representatives appropriately validate the closure of the contractor's corrective actions.

6.3 Weaknesses

DOE program offices have not fully established adequate processes to effectively implement their Headquarters oversight responsibilities. While some progress has been made and performance varies, the program offices that were evaluated in 2007 have significant gaps and deficiencies in their oversight processes. Program offices have not completed some of the actions necessary to fully implement their programs for meeting the requirements of DOE Order 226.1, *Implementation of Department of Energy Oversight Policy*, in such areas as development of issues management programs, contractor assurance system performance expectations, annual assessment schedules, lessons-learned programs, employee concerns, self-assessments, startup or restart of nuclear facilities, and review and approval of safety basis documentation. In many cases, program offices do not have adequate program documents and implementing procedures. The weaknesses in Headquarters issues management programs are particularly significant and have contributed to situations where program offices did not ensure that corrective actions were complete and where program offices provided inaccurate information to the Secretary of Energy and the Defense Nuclear Facilities Safety Board.

DOE program offices have not always provided adequate direction to, support for, and oversight of their site offices. Program offices have not always ensured that their site offices perform adequate oversight of their contractors or develop effective contractual performance metrics. At one site, a program office was aware that site offices had longstanding or recurring deficiencies and were experiencing problems with management direction and gaps in technical resources; however, the program office did not take adequate actions to provide direction and/or arrange for additional expertise and technical resources (e.g., using Service Centers, detailing personnel) to address the gaps in technical staff capabilities. As a result, one significantly deficient site office program degraded further. With some exceptions (e.g., CDNS reviews), Headquarters program office oversight of site offices has been limited. Most program offices have not yet taken sufficient actions to assist site offices, such as establishing common processes for site office operations to relieve their burden in establishing and maintaining processes and procedures. Further, some program offices have not always provided sufficient leadership and established adequate expectations to ensure that priority issues, such as the adequacy of specific administrative controls for nuclear facilities and workplace monitoring programs, are provided sufficient oversight attention and are adequately addressed.

DOE site office oversight programs have not always been sufficiently effective to consistently identify deficiencies and drive improvements in contractor ISM programs. Although some individual program elements are effective (e.g., Facility Representatives at some sites), all of the evaluated site offices have

some weaknesses in oversight programs that hinder their effectiveness in ensuring continuous improvement in contractor ISM programs. Site offices typically perform a significant number of assessments of ES&H elements (e.g., radiation protection) but often do not adequately evaluate performance (e.g., evaluation of work activities) and do not sufficiently evaluate contractor management processes (e.g., evaluation of the effectiveness and implementation of the contractor assurance system). In some cases, site offices' assessment programs do not sufficiently assess all safety topical areas, and the scope and rigor of many assessments are insufficient. For example, several site offices have not adequately evaluated industrial hygiene programs and important industrial hygiene requirements, such as workplace monitoring. Issues are not always adequately evaluated, and recurrence controls are often not established for addressing root and contributing causes. Some site offices have gaps in technical expertise (e.g., industrial hygiene, nuclear safety) that impact the quality of their oversight efforts. With some exceptions, site offices have not taken full advantage of opportunities to use contractual performance objectives to focus contractor management attention on priority ES&H issues and to drive performance improvements. The weaknesses in site office oversight are a contributing factor to the deficiencies in contractor ISM programs.

6.4 Opportunities for Improvement

Line Management in Coordination with the Federal Technical Capabilities Panel

1. **Conduct an evaluation to determine additional competencies associated with oversight processes that should be applied to SMEs who perform oversight of ISM.** Consider developing or enhancing competencies to ensure that Federal personnel can effectively perform their oversight function. Working-level competencies for personnel who perform oversight of contractor ISM programs or elements of ISM should include contract management, issues management, assessment strategies, data analysis, performance metrics, event investigation, oversight of contractor assurance systems, and work planning and control. Determine the best mechanism for applying those competencies to personnel who perform ISM oversight, such as adding competencies to the current qualification standards or alternative means.

DOE Line Management

1. **Expedite establishment of program office issues management processes that emphasize causal analysis, management accountability, and focus on determining the effectiveness of actions in preventing recurrence.**

2. **Consider establishing, where appropriate, common or standardized processes for site office operations wherever feasible.** Site offices perform similar functions and utilize their own resources to develop and maintain duplicative processes and procedures; such efforts take away time that could be spent on conducting their oversight functions. Evaluate opportunities to standardize and centralize a large number of procedure development and maintenance efforts across program offices and to assign major responsibilities to non-site office resources in such areas as the technical qualification, Facility Representative, and safety system oversight programs, and development of assessment guides and criteria for critical functions (e.g., evaluation of contractor assurance systems). Encourage the use of tools, such as Pegasus, to facilitate issues management, action tracking, and other such functions.

3. **Ensure that more emphasis is placed on evaluating management systems (e.g., contractor assurance system, work control processes).** Develop a common approach for determining the overall effectiveness

of contractor assurance systems. Develop and utilize tools for evaluating the implementation of contractor assurance system elements similar to those currently available for work planning and control (see Section 3.4, Opportunity for Improvement #2 under the DOE Line Management subsection).

4. **Continue to enhance the use of contract performance-based incentives to promote improvement in contractor ES&H performance.** Target performance-based incentives on key issues and more results-oriented metrics for evaluating performance in key areas that need improvement, such as contractor assurance systems, work control, and the cognizant system engineer program. Ensure that performance-based incentives for developing programs focus on successfully accomplishing significant milestones and include challenging provisions for measuring "success," rather than designing a measure that simply relies on a declaration that a milestone is met. Ensure that performance-based incentives focus on the quality of ES&H programs, identify indicators of program deficiencies, and are designed to better reflect the true status of key performance areas and to promote sound decision-making.

Abbreviations Used in This Report

AIHA	*American Industrial Hygiene Association*
BNL	*Brookhaven National Laboratory*
CDNS	*Chief, Defense Nuclear Safety*
CEDE	*Committed Effective Dose Equivalent*
CF	*Core Function*
CFR	*Code of Federal Regulations*
D&D	*Decontamination and Decommissioning*
DOE	*U.S. Department of Energy*
DOEHRS	*Defense Occupational & Environmental Health Readiness System*
EFCOG	*Energy Facilities Contractor Group*
EM	*Office of Environmental Management*
ES&H	*Environment, Safety, and Health*
HASS	*Hazard Assessment and Sampling System*
HSS	*Office of Health, Safety and Security*
INL	*Idaho National Laboratory*
ICP	*Idaho Cleanup Project*
ISM	*Integrated Safety Management*
LANL	*Los Alamos National Laboratory*
LLNL	*Lawrence Livermore National Laboratory*
MFC	*Materials and Fuels Complex*
NE	*Office of Nuclear Energy*
NNSA	*National Nuclear Security Administration*
NTS	*Nevada Test Site*
ORPS	*Occurrence Reporting and Processing System*
OSHA	*Occupational Safety and Health Administration*
PPE	*Personal Protective Equipment*
SC	*Office of Science*
SME	*Subject Matter Expert*
TEDE	*Total Effective Dose Equivalent*