

**Inspection of
Environment, Safety,
and Health Programs
at the**



Los Alamos National Laboratory

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Abbreviations Used in This Report

CDNS	<i>NNSA Chief, Defense Nuclear Safety</i>
CFR	<i>Code of Federal Regulations</i>
DNFSB	<i>Defense Nuclear Facilities Safety Board</i>
DOE	<i>U.S. Department of Energy</i>
EMS	<i>Environmental Management System</i>
ES&H	<i>Environment, Safety, and Health</i>
EWMO	<i>Environmental and Waste Management Facility Operations</i>
FRAM	<i>Functions, Responsibilities, and Authorities Manual</i>
FY	<i>Fiscal Year</i>
HSS	<i>DOE Office of Health, Safety and Security</i>
ISM	<i>Integrated Safety Management</i>
ISO	<i>International Standards Organization</i>
IWD	<i>Integrated Work Document</i>
KSL	<i>KBR-Shaw-LATA</i>
LANL	<i>Los Alamos National Laboratory</i>
LANS	<i>Los Alamos National Security, LLC</i>
LASO	<i>Los Alamos Site Office</i>
MSS	<i>LANL Maintenance and Site Services Division</i>
NNSA	<i>National Nuclear Security Administration</i>
PPE	<i>Personal Protective Equipment</i>
R&D	<i>Research and Development</i>
RANT	<i>Radioassay and Nondestructive Testing</i>
RLWTF	<i>Radioactive Liquid Waste Treatment Facility</i>
SAC	<i>Specific Administrative Control</i>
TA	<i>Technical Area</i>
TSR	<i>Technical Safety Requirement</i>
WCRRF	<i>Waste Characterization, Reduction, and Repackaging Facility</i>
WETF	<i>Weapons Engineering Tritium Facility</i>

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1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight, within the Office of Health, Safety and Security (HSS), inspected environment, safety, and health (ES&H) programs at the DOE Los Alamos Site Office (LASO) and Los Alamos National Laboratory (LANL) during October through December 2007. HSS reports directly to the Secretary of Energy, and the ES&H inspection was performed by Independent Oversight's Office of Environment, Safety and Health Evaluations.

Within DOE, the National Nuclear Security Administration (NNSA) has line management responsibility for LANL. NNSA provides programmatic direction and funding for research and development (R&D), facility infrastructure activities, and ES&H implementation at LANL. At the site level, line management responsibility for LANL operations falls under the LASO Manager.

Under contract to DOE/NNSA, LANL is managed and operated by Los Alamos National Security, LLC (LANS), which is a limited liability corporation formed by Bechtel National, the University of California, BWX Technologies, and Washington Group International. LANS assumed operational responsibility for LANL on June 1, 2006. As part of the contract transition, NNSA and LANS recognized that LANL ES&H programs and processes had a number of deficiencies that would take some time to address. For some of these areas, LASO and LANS identified improvement plans and schedules.

LANL's primary mission is to provide scientific and engineering support to U.S. national security programs. LANL performs R&D, design, maintenance, and testing in support of the nuclear weapons stockpile. LANL also performs theoretical and applied R&D in such areas as materials science, physics, environmental science, energy, and health.

To support these activities, LANL operates numerous laboratories, test facilities, and support facilities and performs such activities as facility maintenance and waste management. LANL activities involve various potential hazards that need to be effectively controlled, including exposure to radiation, radiological contamination, nuclear criticality, hazardous chemicals, and various physical hazards associated with facility operations (e.g., machine operations, high-voltage electrical equipment, pressurized systems, noise, and construction/maintenance activities). Large quantities of fissile and radioactive materials are present in various forms at LANL.

The purpose of this Independent Oversight inspection was to assess the effectiveness of ES&H programs at LANL as implemented by LANS under the direction of LASO and NNSA. Independent Oversight evaluated a sample of activities, including:



Aerial view of LANL

- Implementation of the core functions of integrated safety management (ISM) for selected LANL facilities and activities, focusing on work planning and control systems at the activity and facility level. The Independent Oversight inspection selectively evaluated:
 - R&D and fabrication shop work activities in the Threat Reduction Directorate and the Chemistry Division.
 - Facility work activities, focusing on operations work performed by the Environmental and Waste Management Facility Operations Division (EWMO) Facility Operations Directorates at selected facilities, including the Radioactive Liquid Waste Treatment Facility (RLWTF); the Waste Characterization, Reduction, and Repackaging Facility (WCRRF); the Radioassay and Nondestructive Testing facility (RANT); and a number of G Area waste storage and processing domes.
 - Facility maintenance work performed by KBR-Shaw-LATA (KSL) Services.
 - Essential system functionality for selected safety systems at the Weapons Engineering Tritium Facility (WETF), which is a hazard category 2 nuclear facility located at Technical Area (TA)-16. The systems selected were the safety-significant fire protection system and the tritium gas containment system, and selected interfacing and support systems. The Independent Oversight team also performed a limited review of the status of selected corrective actions to weaknesses in essential system functionality identified in the 2005 Independent Oversight ES&H inspection at TA-55 and examined the ongoing LANL institutional engineering improvement initiative.
 - LASO and LANL effectiveness in managing and implementing selected aspects of the ES&H program that Independent Oversight has identified as focus areas, including elements of environmental management system (EMS) and pollution prevention program implementation, administrative controls for nuclear facilities, and safety system component procurement. Although these topics are not individually rated, the results of focus-area reviews are integrated with or considered in the evaluation of other ISM elements. In examining these areas, Independent Oversight focused primarily on the application of institutional programs to LANL at the activity and facility levels.
 - NNSA, LASO, and LANL feedback and continuous improvement systems, with a focus on their application to LANL facilities and activities that were evaluated on this Independent Oversight inspection. The review of feedback and improvement systems also constitutes the Independent Oversight evaluation of the effectiveness of LANL and LASO/NNSA implementation of DOE Order 226.1, *Implementation of DOE Oversight Policy*, which is a long-term Independent Oversight focus area.

Sections 2 and 3 discuss the key positive attributes and weaknesses, respectively, identified during this inspection. Section 4 provides a summary assessment of the effectiveness of the major ISM elements that were reviewed. Section 5 provides Independent Oversight's conclusions regarding the overall effectiveness of NNSA, LASO, and LANL management of ES&H programs, and Section 6 presents the ratings assigned during this inspection. Appendix A provides supplemental information, including team composition.

Appendix B presents the findings identified during this Independent Oversight inspection. In accordance with DOE Order 470.2B, *Independent Oversight and Performance Assurance Program*, NNSA must develop a corrective action plan that addresses each of the findings identified in Appendix B. In most cases, the findings listed in Appendix B were derived from multiple individual deficiencies that are described in the

detailed results provided to the site in a separate document. NNSA, LASO, and LANL need to ensure that the corrective action plan for the Appendix B findings addresses these individual deficiencies and includes appropriate causal analyses, corrective actions, and recurrence controls. The findings are referenced in Sections 3 and 4 of this report. The weaknesses in Section 3 provide a management-level summary of the findings; the weaknesses do not need to be separately addressed in the NNSA corrective action plan because the findings encompass the scope of the weaknesses.

Within the LANL ISM system, IMP-300.4, *Integrated Work Management for Work Activities*, is the ES&H procedure that describes the LANL integrated work management process. The work that was reviewed by Independent Oversight on this inspection was conducted under the provisions of IMP-300.4. Near the end of the Independent Oversight inspection (November 30, 2007), LANL issued a revision to this procedure (IMP-300.5). Independent Oversight reviewed elements of the new procedure to determine whether it addressed concerns identified during this inspection and to provide preliminary feedback to LANL management.

2 Positive Attributes

Positive attributes were identified in several ES&H programs, particularly in certain aspects of new programs and initiatives.

LANL has taken a number of important steps to strengthen work planning and control. First, the recent creation of Facility Operations Director organizations has enhanced the work control process. The Facility Operations Directors coordinate the efforts of all deployed personnel and ES&H services to ensure that all facility and programmatic activities are integrated and have the potential to address longstanding concerns, such as addressing aggregate hazards from multiple work groups and/or areas. This improvement is particularly evident within the Chemistry Division and the Threat Reduction Directorate. Second, EWMO has significantly improved conduct of operations at WCRRF by placing a high level of emphasis on planning safe and compliant operations. In G Area, EWMO has also made effective use of engineered controls, such as Perma-Con confinement structures, to limit the potential spread of contamination and airborne radioactivity during invasive radiological work. Third, for maintenance activities, work planning and control has been strengthened by development of a comprehensive LANL Conduct of Maintenance Manual and implementing administrative procedures. As part of this effort, the maintenance organization has addressed longstanding problems by identifying hazards and controls in work control documents for most maintenance work, instead of relying on workers to perform these functions after they are assigned the work.

New nuclear safety programs and initiatives and LANL organizational changes have the potential to address the programmatic and organizational root causes of longstanding deficiencies in the LANL safety basis and form a sound foundation for effective nuclear safety management at LANL. LANL's cognizant system engineer program is well designed to significantly strengthen the engineering roles, responsibilities, and functions at nuclear and high hazard facilities. LANL's integrated formality of operations program and Safety Basis Improvement Initiative are systematic and comprehensive approaches (e.g., technical baseline validation) to address the fundamental and persistent weaknesses in safety system engineering and safety basis. Conduct of maintenance at LANL has been improved as a result of changes in organization that better align maintenance resources, more clearly document and communicate expectations, and provide better training on meeting functional responsibilities. Organizational changes, such as the independent Engineering and Engineering Sciences organization, the Site Chief Engineer position, and Design Authority Representatives for each nuclear facility, have also enhanced the nuclear safety programs by clarifying responsibilities and accountability for the safety bases and the engineering processes and by ensuring that nuclear safety issues are communicated to senior LANL management for



Aerial view of Radioactive Liquid Waste Treatment Facility

resolution. Although there is a need for additional actions to address current risks, implementation of these programs at TA-55, which has piloted the programs and made the most progress, is appropriately addressing the root causes of longstanding deficiencies.

LANL has established or initiated a number of new programs that are well designed to enhance elements of the LANL contractor assurance system. First, management review boards provide a potentially effective means for managers at all levels to become directly engaged in evaluating and managing safety issues and communicating performance expectations to staff. Second, LANL is building the framework for a valuable and effective management tool for performance measurement and monitoring through a comprehensive, structured, and well-designed “dashboard” metrics system. This multi-tiered “dashboard” of over 2000 individual, weighted indicators, when fully developed, should provide LANL management at all levels with current and reliable lagging and leading indicators of performance for numerous areas important to the management of LANL, including achievement of goals and contract measures, and compliance with regulations and requirements. Third, the Director’s institutional assessment program provides a rigorous, independent, multi-disciplined evaluation of performance at individual facilities and will provide valuable information to management on overall implementation of safety programs at LANL. The Director’s assessments provide in-depth reviews of numerous management systems and safety functional areas by independent subject matter experts that provide management with a broad view of the overall safety performance at an organization or facility at that point in time. As assessments are performed at additional facilities, the resulting information can be analyzed and trended, and then used by senior management and program owners to improve LANL-wide processes and performance.

3 Weaknesses

Although some aspects of ES&H management are effective, there are numerous weaknesses in ISM programs at LANL, most significantly in implementation of work processes, certain safety controls, radiation protection, essential system functionality, and feedback and continuous improvement processes.

The LANL integrated work management process does not provide adequate guidance and requirements to ensure that all activity-level hazards are fully analyzed and effective controls developed. IMP-300.4 and other institutional work management documents such as the LANL Conduct of Operations Manual contain several weaknesses or deficiencies that significantly contribute to implementation problems observed during both this and the 2005 Independent Oversight inspection. First, the IMP-300.4 process has not been integrated with conduct of operations. Although technical procedures are the primary administrative control in routine operations and preventive maintenance activities involving moderate or high hazards, neither the LANL Conduct of Operations Manual nor the integrated work management process provides adequate guidance or requirements on expectations for integration of job hazard assessments and integrated work documents (IWDs). Next, although the IMP-300.4 process is being used for research activities, there is minimal guidance in applying IMP-300.4 to research work. A conduct of research implementation support procedure has been in development for over nine months, but progress toward approval has been slow. Other deficiencies include inadequate criteria in the hazard grading matrix, no quantitative or qualitative triggers for ES&H subject matter expert involvement for moderate hazard activities, and inadequate guidance for standing IWDs or IWDs for long-duration activities. The new IMP-300.5 procedure provides some improvements in the work control system but does not adequately address most of the weaknesses in the work control process that were identified during this Independent Oversight inspection. (See Finding #C-1.)

Weaknesses in implementation of work planning processes have resulted in ineffective analysis of hazards and incomplete specification of controls for some work activities by all of the organizations that were reviewed. Notwithstanding the institutional concerns about IMP-300.4, expectations are clearly defined that require systematic analysis of hazards and linkage to specific controls. In a number of examples, the reviewed facilities had not met these objectives. In EWMO, institutional requirements for hazard analysis, such as use of the job hazard assessment tool or equivalent processes, are sometimes not followed, and hazard grading criteria are not always properly or conservatively applied, resulting in the lack of a requirement for subject matter expert involvement in work planning. As a result, hazards are not always properly identified and analyzed, and controls for work activities sometimes lack technical justification and are poorly defined or inadequate. For R&D and fabrication shop activities conducted within Chemistry and Threat Reduction, some work activities are not sufficiently defined in IWDs such that hazards and controls can be readily identified, particularly for work performed infrequently or for complex R&D activities. Exposure assessments have not been performed for a number of activities, and some hazard controls have not been communicated or effectively implemented. For maintenance activities, although progress has been made, there are continuing deficiencies in the area of work planning, where hazards are not always identified and analyzed, and applicable controls are not always established in work control documents. Additional deficiencies were found in the area of work performance, where workers do not always follow IWD requirements and persons in charge do not ensure compliance. (See Findings #C-5, #C-6, #C-9, #C-13, and #C-14.)

Institutional radiological protection requirements have not always been followed or properly flowed down through procedures such that radiological controls are adequate, clearly defined, and effectively implemented. Independent Oversight identified concerns about institutional requirements flowdown and specific implementation deficiencies. At the institutional level, methods used to enroll workers in a bioassay program have not been adequate to ensure that workers are monitored for the correct isotopes and at the required frequencies. In addition, the current radiological work permit process does not provide the procedural direction needed to ensure institutional expectations are clearly defined and that resulting controls are adequate. Further, EWMO has not adequately implemented specific institutional radiation protection requirements in the areas of procedure approvals, personal protective equipment (PPE), postings, and contamination control. Within the Chemistry Division, specific institutional radiation protection requirements for contamination control are not adequately flowed down and/or implemented. (See Findings #C-7, #C-8, and #C-12.)

Several institutional safety and health programs lack sufficient procedures, policies, and/or training requirements to ensure that hazards are adequately controlled. LANL does not have sufficient procedures, policies, and training of workers with respect to the use of hydrofluoric acid and when working with nanomaterials. Chemical fume hood procedures, testing, and user training do not have sufficient rigor to ensure that chemical fume hoods provide the level of worker protection that is assumed by line management. The LANL hazard communication and cryogen programs do not have sufficient definition in some areas to be effectively and consistently implemented, particularly with respect to inclusion of some commonly used hazardous chemicals and the calculation of the potential for oxygen-deficient atmospheres when using cryogenics. (See Findings #C-2, #C-3, and #C-4.)

LANL senior management has not ensured sufficient rigor in enforcing safety requirements at RLWTF and has not ensured that facility conditions and operations at RLWTF comply with environmental regulations, institutional safety and conduct of operations requirements, and assumptions and initial conditions of the facility safety basis. In the most significant example, LANL senior management has allowed the liquid waste collection system to degrade to a condition where: (1) based on Independent Oversight's review of a 2004 LANL engineering review and current system status, the integrity of the stainless steel and carbon steel portions of the primary piping is severely degraded, and the secondary containment barrier between the system and the environment is not intact; (2) 23 of 65 of the secondary collection sumps contain liquid levels in excess of the leak detection alarm set points; (3) 9 of 23 vaults with water have not been analyzed to determine whether the water is due to a primary system leak (LANL reports that the other 14 have now been analyzed and determined to contain rainwater and not water from a primary leak); and (4) the leak detection alarm system is no longer capable of detecting a primary leak because of the water inventory and other deficiencies. Under these conditions, an undetected leak in the primary collection line releasing to the environment through faults in the secondary containment vaults cannot be precluded. Additionally, even if all sumps are later determined not to contain radioactive liquids, the current condition of the system is not capable of detecting a future leak. In another example, a room in the RLWTF has been used as a storage area for diesel fuel and waste oil for months. However, the RLWTF safety analysis report never analyzed that room as a fuel storage area and never considered that amount of combustible fuel in the room. Management did not perform an analysis (an unreviewed safety question determination) to ensure that using the room as a fuel storage area met the assumptions of the safety analysis. Several other deficiencies in material conditions and conduct of operations further indicate that significantly increased senior management attention is needed to improve the safety of RLWTF operations. (See Findings #C-10 and #C-11.)

The ability of some WETF essential safety systems to perform their safety functions is not adequately assured because of deficiencies in the safety basis, procurement, and operations. WETF safety bases do not have sufficient analysis of potential differential-pressure threats to the integrity of the TGCS and the capacity of the pressure relief bubblers to address these threats. Additionally, WETF safety bases are not supported by adequate design documentation and analyses to demonstrate that pressure relief bubblers and other safety systems can perform their safety functions. Several areas were identified where WETF safety system designs did not completely and/or correctly reflect the performance requirements of the safety bases

and/or good engineering practices. Once the issues were identified, WETF responded in accordance with the documented safety analyses and the USQ process. In some areas, the safety bases or the designs were not completely and/or correctly translated into facility technical safety requirements (TSRs), procedures, and practices. In several instances, WETF safety systems were operating outside the procedurally imposed safety limits. (See Findings #E-3 through #E-10, and #E-12.)

LANL's approach to safety basis improvements has not sufficiently focused on engineering design weaknesses and on identifying, prioritizing, and addressing potential technical vulnerabilities in essential safety systems. While the new LANL programs and initiatives are well designed and appropriate, the programs are multi-year efforts and do not include adequate provisions for addressing current technical vulnerabilities. The Independent Oversight review of WETF indicated that significant safety system technical deficiencies had not been identified, and thus potential risks were not sufficiently analyzed. Because of the longstanding weaknesses in LANL safety bases programs, similar conditions are likely at other LANL facilities. Further, even at TA-55, which has made the most progress in enhancing safety bases, a number of important design weaknesses were not adequately evaluated and addressed. These deficiencies are partially attributed to longstanding weaknesses in the cognizant system engineer program and shortages of LANL personnel with expertise in design engineering and safety basis evaluations. Increased management attention is needed to accelerate enhancements in nuclear safety and to ensure that the higher risks are identified, analyzed, and addressed on a timelier basis, while still sustaining the important longer-term initiatives. (See Findings #E-1, #E-2, and #E-11.)

Although progress has been made since the 2005 Independent Oversight inspection, LANL has not fully developed and rigorously implemented an effective contractor assurance system. The rollout of new and revised assurance system processes was not performed with sufficient controls and monitoring to ensure that requirements were adequately communicated or that organizations were implementing the processes effectively. Requirements and processes for assurance of system elements are often insufficiently and inconsistently defined in institutional procedures, and organizational implementing procedures are lacking. Line and support organizations have not implemented assurance systems in a sufficiently rigorous, compliant, or effective manner. Organizations have not selected, scheduled, and performed management assessments based on structured, risk-based, documented methods that assure that all pertinent management systems, safety functions, and work activities are assessed at an appropriate frequency. Few formal self-assessments evaluate work activities. Safety process implementation and self-assessment activities often lack sufficient depth and rigor to provide an accurate evaluation of program implementation and effectiveness. Although many individual issue tracking systems have been consolidated into the institutional system and more issues are formally tracked, process weaknesses in identifying causes and extent of condition, and in timeliness and risk categorization limit the institutional system's effectiveness. Action plans to address significant, longstanding safety deficiencies in numerous management systems have not been effective and are insufficiently monitored to ensure effectiveness in a timely manner. (See Findings #D-8 through #D-11.)

Little progress has been made in addressing weaknesses and deficiencies in occupational injury and illness management and operational experience/lessons learned programs since 2005. Institutional procedures are still not in place. Injury investigations and lessons-learned analysis and application are inadequately documented. Injury and illness investigations are insufficiently rigorous and are not effective in identifying causes. No investigation of first-aid cases is performed, although many such precursor incidents reflect deficiencies in work management processes and unsafe worker behavior. LANL lacks documentation demonstrating consistent and appropriate application of lessons learned including documentation that evaluations for applicability were performed, any needed actions were identified, and that implementation of those actions was verified. Management has not adequately monitored assurance system implementation and ensured accountability for effective performance. (See Findings #D-8, #D-10, and #D-11.)

NNSA/LASO management direction and oversight have continued to be ineffective in ensuring that longstanding weaknesses in LASO programs and LASO oversight of LANL ES&H programs are adequately evaluated, understood, and addressed. The 2005 Independent Oversight inspection determined that NNSA and LASO oversight programs were inadequate and that timely actions were needed to address

a number of important weaknesses in LASO oversight processes and activities. With a few exceptions (e.g., the LASO employee concerns program and some improvements in management of the contract provisions), the same weaknesses were evident during this Independent Oversight inspection at both NNSA Headquarters and LASO in such areas as contractor assessments, issues management, the Facility Representative program, self-assessments, and processes and procedures. While the NNSA Chief, Defense Nuclear Safety (CDNS) organization has recently performed some effective assessments of NNSA and LASO, NNSA did not adequately monitor and review the status of LASO corrective actions for previous findings. In addition, NNSA has not taken actions to provide direction and support to LASO in addressing such problems as shortfalls in nuclear safety expertise and inadequate processes and procedures. LASO has made limited progress in strengthening its programs and processes for oversight of contractor ES&H performance. LASO assessments of contractor performance have not been consistently performed or appropriately documented, and many scheduled assessments were not completed in fiscal year (FY) 2007. LASO procedures and processes have numerous deficiencies and, in some cases, are not fully implemented. The LASO operational awareness process lacks clearly communicated expectations for the frequency, content, quality, or rigor of documentation. LASO continues to have difficulty in managing and tracking issues and in the timely and effective closure of corrective actions. Contrary to management's stated intentions in 2005, LASO oversight activities for nuclear safety have decreased since then, and LASO has not established the required safety system oversight program; these weaknesses contribute to LASO's lack of success in driving improvements in safety system performance at LANL nuclear facilities. Lastly, although longstanding process and performance deficiencies in most of the major elements of LASO oversight have been identified by Independent Oversight and NNSA assessments, NNSA and LASO do not have a realistic, strategic plan for addressing these problems in conducting oversight (e.g., insufficient direction; staffing skill mix issues; insufficient priority on important elements of the contractor program, such as the contractor assurance system; and the effectiveness of ongoing LANL improvement efforts), identifying oversight priorities, and ensuring that LASO provides adequate oversight of the most important LANL ES&H programs and initiatives. (See Findings #D-1 through #D-7, and #E-13.)

4 Results

The following sections provide a summary assessment of the NNSA, LASO, and LANL activities that Independent Oversight evaluated during this inspection.

4.1 Work Planning and Control Processes

The Independent Oversight review of work planning and control processes focused on review of the adequacy and implementation of institutional expectations and requirements for activity-level work planning and control as described in implementing procedure IMP-300.4. This review also included a focus on progress toward correcting work control deficiencies identified during the 2005 Independent Oversight review.

The inspection results indicate that some aspects of work planning and control at LANL are improving as a result of initiatives, such as the Facility Operations Directors, emphasis on conduct of operations, and efforts to enhance maintenance work planning. However, there continue to be a number of weaknesses in processes and performance, many of which are similar to those identified by Independent Oversight in 2005. Institutional weaknesses include deficiencies in the LANL work management process, testing and use of chemical fume hoods, hazard communications, and institutional programs for certain hazards, such as cryogenics. At the facility and activity levels, some of the new initiatives are having a positive impact in some cases. However, weaknesses were also evident in each of the evaluated organizations, facilities, and activities (as discussed in the following subsections). The new IMP-300.5 procedure does not address most of the weaknesses identified during this Independent Oversight inspection. (See Findings #C-1, #C-2, #C-3, and #C-4.)

Chemistry and Threat Reduction

LANL R&D work control processes were evaluated through a sampling of research, production, and fabrication shop work activities within the Chemistry Division and Threat Reduction Directorate. Line operations within these groups are supported by the newly formed Science and Technology Operations Facility Operations Director.

Development of IWDs in the Chemistry Division and the Threat Reduction Directorate is improving. However, not all IWDs have benefited from this improved rigor in IWD development, and not all have sufficient work description to adequately identify hazards and controls. Also, for research activities, some IWDs do not sufficiently describe the activity-level work activities such that the hazards can be identified and the hazard controls can be verified as being “bounded” by the IWD task description. Furthermore, in machine shops and research activities, infrequent work activities (which may be more hazardous than some routine operations) are not described or addressed in some IWDs. (See Finding #C-5.)



Hot cell activities

Many of the ES&H hazards associated with research and fabrication shop work performed in the Chemistry and Threat Reduction labs and shops have been adequately identified, analyzed, and documented. However, many workplace exposures to chemicals, physical agents, and ergonomic stressors associated with chemical fume hoods and gloveboxes have not been adequately assessed, documented, incorporated into work control documents, or communicated through hazard communication postings. (See Finding #C-6.)

The Chemistry Division and the Threat Reduction Directorate have improved many aspects of hazard controls, particularly in the areas of controlling aggregate hazards, identifying and describing specific controls in IWDs, implementing the control and inventory of hazardous chemicals, and identifying and removing legacy hazards. However, a number of concerns remain, particularly with respect to chemical fume hoods, radiological control practices, inadequate institutional controls for certain hazards (e.g., hydrofluoric acid and nanomaterials), hazard communication postings, and chemical glove usage. (See Findings #C-2, #C-3, #C-4, #C-6, and #C-7.)

In general, both research work and fabrication shop work observed by Independent Oversight were performed within controls specified within IWDs. However, some exceptions were noted, and as discussed above, the proper controls were not always in place. (See Finding #C-6.)

Overall, improvement has been observed in many areas, such as description of work, hazard identification, and specificity of controls within IWDs, in the Chemistry Division and the Threat Reduction Directorate since the 2005 DOE Independent Oversight inspection. The Facility Operations Director concept, although recently reorganized for these groups as the Science and Technology Operations Facility Operations Director, has had a number of positive effects on the identification and control of hazards. There has also been notable improvement in such areas as the inventory and storage of laboratory chemicals, identification and control of area and aggregate hazards, and increased involvement of subject matter experts in work activities. However, weaknesses are still evident in a number of areas, such as insufficient description of work activities for some multi-faceted research projects, infrequent work activities in the IWD process, insufficient rigor in exposure assessments for chemicals, inadequate physical hazards identification and mitigation, inadequate radiological controls in radiochemistry labs, insufficient rigor in the testing and use of chemical fume hoods, hazard communication postings inconsistent with IWDs, insufficient management of non-laboratory hazardous materials, and lack of institutional programs for hydrofluoric acid and nanomaterials to ensure that workers are adequately protected.

EWMO

EWMO activities were evaluated through work activity observations and document reviews for a variety of hazardous, low-level radioactive, and transuranic waste management operations at the RLWTF, WCRRF, RANT, and a number of G Area waste storage and processing domes.

Work scopes are generally well defined in operating procedures and IWDs; however, radiological work permit task descriptions are often not detailed enough to ensure development of appropriate radiological controls.

The primary method of hazard analysis for activity-level work at EWMO is the IMP-300.4 process for IWDs and the conduct of operations process for technical procedure development. However, implementation of these processes has not been effective in a number of cases. Although most WCRRF operations activity hazards have been effectively analyzed through the extensive safety basis and technical procedure development efforts, the environmental, industrial, and exposure hazards at other EWMO facilities have not been adequately identified or analyzed. Hazard grading criteria are not properly or conservatively applied, and EWMO facilities have not followed all institutional requirements for hazard analysis. (See Finding #C-9.)

Many hazard controls within EWMO are appropriate and effective. Safety basis controls at WCRRF, including specific administrative controls, are comprehensive. Operating procedures at WCRRF, RANT, and RLWTF are generally detailed, and there is good use of engineering controls in some areas such as the use of Perma-Cons and local ventilation at G Area. However, IMP-300.4 implementation deficiencies result in unclear and/or potentially deficient controls. Integration of radiological controls with the IWD process is not well defined or effective, in part because of inadequate institutional requirements governing bioassay enrollment and

development of radiological work permits. Also, EWMO has not properly implemented various institutional radiation protection requirements in the areas of procedure approvals, PPE, postings, and contamination control. At RLWTF, inattention to the physical condition of the radioactive liquid waste collection system has increased the risk of an unmonitored and undetected radioactive liquid release to the environment. (See Findings #C-7, #C-10, and #C-12.)

Readiness to perform work in EWMO facilities is adequately implemented using plan-of-the-day schedules, morning meetings, crew briefings, and pre-job briefs. Workers performed a number of discrete activities in accordance with established controls. However, safety concerns and failures to follow established safety, radiological, and contamination controls were identified at RLWTF. (See Findings #C-11 and #C-12.)

Overall, some aspects of work planning and control at EWMO facilities are effective, and LANL has made significant progress at WCRRF. However, EWMO has not adequately implemented many aspects of institutional ISM requirements, resulting in deficiencies in hazard analysis, hazard controls, and procedure adherence. Increased LANL management attention is needed to ensure that the IMP-300.4 process is effectively integrated with activities governed by technical procedures at EWMO and other LANL facilities. Increased EWMO management attention is needed to ensure that all activity hazards are adequately analyzed and controlled and that all EWMO activities are performed safely and in accordance with established controls, particularly at RLWTF. Significant LANL and LASO management attention is also needed to address deficiencies in the physical condition of RLWTF and to evaluate options for compensatory measures and interim corrective actions.

Maintenance

This Independent Oversight inspection assessed the safety of maintenance activities planned and coordinated by LANL Maintenance and Site Services Division (MSS) and performed by KSL in various LANL technical areas. KSL is a support contractor to LANS that performs maintenance work under the programmatic direction of MSS.

An adequate process has been established and implemented for defining the scope of maintenance work through the maintenance implementation procedures for work control. The scope of work is adequately defined on most IWDs and is broken down into tasks in sufficient detail to support hazard analysis.

The work planning process for maintenance has been strengthened since the 2005 Independent Oversight inspection, and requirements have been established in IMP-300.4 for identification and analysis of hazards associated with maintenance work. However, some deficiencies remain, including inadequate implementation of requirements through the MSS planning process and job hazards analysis tools that have not been fully effective. A number of hazards (e.g., noise, physical hazards, asbestos and other hazardous materials) associated with work reviewed by the Independent Oversight team were not identified or adequately analyzed during maintenance planning and were not adequately addressed in maintenance work packages. (See Finding #C-13.)

For KSL maintenance, the institutional work control processes specified in IMP-300.4 have not always been implemented with sufficient rigor to ensure that required controls are consistently included in work control documents. Adequate controls were established in IWDs for most work, but there were systemic deficiencies in the flowdown of training requirements, material safety data sheet controls, and electrical PPE requirements into work control documents, indicating the need for more improvements in the procedures and/or their implementation. In particular, improvements are needed in IMP-300.4 processes to ensure that workers have completed the required training before they are assigned work and to ensure the involvement of subject matter experts in the planning of maintenance work. (See Finding #C-13.)

With some exceptions, controls provided by IMP-300.4 and MSS procedures are adequate for controlling the observed maintenance work performed by KSL. Daily pre-job briefings are used effectively to remind workers of hazards and controls that are applicable to their assigned tasks, and persons in charge are assigned to monitor and direct activities for each maintenance job. While most work was performed safely, a lack of

rigor in implementing established controls and insufficient monitoring of work activities by persons in charge contributed to a number of performance deficiencies, including failure to follow lockout/tagout requirements, unauthorized use of hazardous materials, and other unsafe work practices. (See Finding #C-14.)

Overall, the scope of maintenance work is adequately defined, and work planning and control processes have improved since the 2005 Independent Oversight inspection. However, some deficiencies in IMP-300.4 and its implementation persist in the area of work planning, where hazards are not always identified and analyzed, and applicable controls are not always established in work control documents. Additional deficiencies were found in the area of work performance, where workers do not always follow IWD requirements and persons in charge do not ensure compliance. These process implementation deficiencies are similar to those noted in the 2002 and 2005 Independent Oversight inspections. Continued problems in work planning indicate a need for strengthening the maintenance planning process, with a focus on training of planners and procedure improvements to provide requirements and guidance for obtaining subject matter expert involvement. In addition, there is a continuing need to emphasize the importance of complying with work control documents and to focus on scheduling and assigning persons in charge so that they can devote sufficient attention to assigned jobs in order to ensure compliance.

4.2 Essential Safety System Functionality

The review of essential safety system functionality focused on four areas: (1) LANL initiatives to address longstanding weaknesses in nuclear safety bases and engineering design; (2) effectiveness of LANL corrective actions in addressing the findings from the 2005 Independent Oversight inspection; (3) functionality of selected essential systems at the WETF, which is a hazard category 2 nuclear facility; and (4) the LANL cognizant system engineer program and the LASO safety system oversight.

LANL Initiatives

As part of the contract transition process, the request for proposal highlighted the need for comprehensive programs to address the longstanding weaknesses in safety basis and engineering design at LANL, including their root causes. Significant deficiencies had been identified in safety bases and nuclear operations at LANL facilities in past reviews by various organizations, including LASO, the Defense Nuclear Facilities Safety Board (DNFSB), and Independent Oversight (including the systemic deficiencies identified during Independent Oversight's 2005 inspection of essential system functionality). Although some corrective actions were taken in the past, the root causes of the deficiencies were often not addressed and/or the extent of condition was not properly considered, resulting in recurrences of the same types of problems across LANL nuclear facilities or the failure to recognize and resolve similar problems. Recognizing this situation, LANL has now appropriately focused on developing programs that should result in fundamental and long-lasting institutional improvements, if properly implemented and managed.

Based on Independent Oversight's review of these programs and their current state of development and implementation, LANL has established some well-designed, long-term programs that, with sustained support, have the potential to address the longstanding deficiencies in the safety basis and operations of nuclear facilities at LANL. These programs include the integrated formality of operations program and the Safety Basis Improvement Initiative. The integrated formality of operations program encompasses major efforts to enhance conduct of maintenance, conduct of engineering (which includes the cognizant system engineer program), conduct of operations, and training and qualification. For the most part, these programs are comprehensive and well documented. For example, a comprehensive manual on engineering processes has been developed to govern nuclear safety basis activities, and the cognizant system engineer program has well-defined roles, responsibilities, and training requirements. These initiatives provide an effective framework for driving the development of technical baselines, which are needed to establish effective safety basis and configuration management programs for nuclear facility safety systems.

LANL has also implemented a number of appropriate organizational changes to increase the visibility and priority of safety basis and design. At the site level, LANL has established the independent Engineering and Engineering Sciences organization and the Site Chief Engineer position, which have responsibilities for important sitewide functions, such as reviewing nuclear safety bases. The new organization and position report directly to a LANL Associate Director, providing assurance that nuclear safety issues have senior management attention. At the facility level, LANL has established a design authority representative position for each nuclear facility that is responsible for monitoring and managing the facility safety basis. LANL has also taken appropriate steps to clarify responsibilities and accountability for the safety basis and the engineering design process, such as coordinating the cognizant system engineer and safety basis functions. In a number of cases, LANL has demonstrated a willingness to set aside production priorities to address nuclear safety issues. For example, LANL took appropriate action to stand down tritium operations at WETF as a result of deficiencies identified during this Independent Oversight inspection, and previously scheduled an extended outage at TA-55 to enhance and validate technical baselines (e.g., system diagrams).

Although the changes and new programs are well designed, they are in various stages of development and implementation across LANL facilities, and their benefits have not been realized. TA-55 is piloting the LANL initiatives and is making progress in implementing the new programs and initiatives, while most other LANL nuclear facilities are in earlier stages of implementation of the new programs and initiatives. The organizational changes are well designed, but their effectiveness depends on the knowledge and expertise of individuals in key management and staff positions, such as the facility operations directors and design authority representatives. The experience of these individuals in important areas, such as design engineering and safety basis evaluation, varies considerably. LANL has shortages of “change agents” with the expertise needed to promote improvement and mentor facility personnel, particularly in the area of nuclear safety systems design engineering and analyses. At TA-55, which should be viewed as the LANL nuclear facility “flagship,” several of the broad weaknesses from Independent Oversight’s 2005 inspection in the areas of safety system engineering design, safety basis, configuration management, and maintenance, will not be fully resolved until full implementation and verification of the four fundamental processes integral to LANL’s integrated formality of operations program initiative (conduct of engineering, conduct of maintenance, conduct of operations, and conduct of training and qualification).

Even though the new LANL programs and initiatives are well designed and appropriate to achieve improvements in a multi-year timeframe, they do not include sufficient provisions and a risk-based resource application approach for addressing current vulnerabilities in the safety bases. As discussed below, the Independent Oversight review of WETF indicated that significant safety system technical deficiencies were not identified by current LANL processes. Similar conditions were identified in previous Independent Oversight inspections and are likely to be evident at other LANL facilities that have not realized the benefits of the new programs and initiatives. Even at TA-55, which has made the most progress in enhancing safety bases, a number of important aspects of a previous Independent Oversight finding, encompassing a number of design weaknesses, were not adequately evaluated and addressed. Other current vulnerabilities at TA-55 are summarized below in the context of Independent Oversight’s review of the corrective actions at TA-55. The DNFSB has also recently expressed concerns about the functionality of nuclear safety systems at LANL’s nuclear facilities; these concerns are similar to those identified by Independent Oversight. (See Finding #E-1.)

Corrective Actions at TA-55 for the 2005 Independent Oversight Findings

The 2005 findings fall into two categories: (1) those that LANL could address and close through near-term corrective actions, and (2) those that will require full implementation of ongoing initiatives and programs to fully resolve and verify closure.

For the first category of findings, with one important exception, LANL was able to define appropriate corrective actions to address the findings. These corrective actions are either complete or on schedule. LANL and TA-55 management devoted significant attention to addressing these findings and considering root causes.

However, TA-55 did not adequately resolve one finding, which addressed a number of important safety ventilation system design and safety basis-related issues. For this finding, a number of significant technical

design issues were not adequately considered, the corrective action management process did not ensure that all the related issues were addressed, and the design review and quality assurance processes were not sufficient to identify and correct deficiencies in the analysis and closure packages. As a result, a number of risks have not been sufficiently analyzed. The inadequate resolution of this finding indicates continuing weaknesses in LANL's engineering safety design and quality assurance processes. In addition, the TA-55 efforts to address these deficiencies revealed continuing weaknesses in institutional processes and procedures for analyzing and reporting potential concerns about the safety basis. (See Finding #E-2.)

For the second category of findings, TA-55 is making considerable progress by piloting and applying the new LANL programs and initiatives, such as the conduct of engineering and conduct of maintenance improvement efforts. For example, TA-55 has developed procedures to govern and enhance conduct of engineering and maintenance and has specified additional training requirements for system engineers. The documented safety analysis and TSRs have been revised, and integrated formality of operations program implementation at TA-55 now appropriately focuses first on technical baseline validation and establishing a strong foundation for the cognizant system engineer program. For example, an outage was scheduled for November and December 2007 to revise and upgrade piping and instrumentation diagrams.

However, considerable effort is needed at TA-55 to fully implement the new programs and to adequately resolve the remaining open 2005 Independent Oversight findings. TA-55 has not completed a detailed facility-level work breakdown structure and a realistic resource-loaded schedule for implementing the integrated formality of operations program. In a number of cases, TA-55 is developing facility-level procedures pending the development of institutional procedures. However, a limited review of outage walkdown and non-conformance reporting procedures identified errors, indicating insufficient peer review and quality assurance for new and/or revised procedures. Because of the lack of institutional procedures and tools, several important cognizant system engineer activities required by DOE (i.e., periodic review and analysis of safety system operability, reliability, and material condition) have not yet commenced and are not scheduled for some time. Generally, formal trending and analysis of safety equipment deficiencies and problems are not performed due to the difficulties with identifying and retrieving such data and information. In addition, LANL uses several different databases that are not sufficiently coordinated to ensure that facility and equipment deficiencies, problems, and issues are comprehensively and systematically screened for potential safety basis impacts. TA-55 does not have interim compensatory controls to ensure that the present vulnerabilities do not lead to a potential compromise of nuclear safety at the facility. TA-55 also faces other significant challenges, such as the shortage of system engineering expertise at TA-55 and LANL, that affect their ability to adequately complete the efforts to develop and implement the integrated formality of operations program and other LANL initiatives, and to identify and address current risks on a priority basis through compensatory measures. (See Finding #E-1 and #E-2).

WETF Essential System Functionality

The Independent Oversight review of essential system functionality for the safety-significant fire protection system and the tritium gas containment system examined engineering design and safety bases, surveillance and operations, maintenance, and procurement.

Engineering Design and Safety Basis. The WETF facility engineering and safety basis staffs are, with a few exceptions, very knowledgeable about the facility, its systems, and its design and safety bases. The safety basis documents are generally well written and comprehensive. However, the safety bases do not have sufficient detail to describe specific events that could pose the highest potential differential-pressure threats to the integrity of the tritium gas containment system and the capacity of the pressure relief bubblers to address these threats. Additionally, much of the design documentation and analysis needed to demonstrate or support the ability of safety systems to perform their safety functions does not exist, is not reasonably accessible, and/or is not controlled in a manner to allow confident day-to-day use in facility operations. In several areas, safety system designs did not completely and/or correctly reflect the performance requirements of the safety bases and/or good engineering practices. Furthermore, the safety bases or the designs were not completely and/or correctly translated into facility TSRs, procedures, and practices. Safety systems were observed

operating outside procedurally imposed safety limits in several instances. Collectively, these deficiencies raise questions about the ability of the safety systems to fully perform their credited safety functions. Upon learning of these deficiencies, WETF staff promptly initiated appropriate actions to place the facility in a safe condition (including curtailing tritium operations). While the facility is in a safe condition, WETF personnel are working to better understand the identified technical concerns, implementing appropriate evaluation and reporting processes, and determining additional needed actions. (See Findings #E-3 through #E-6.)

Surveillance and Operations. Surveillance activities and operations at WETF are generally conducted by experienced and trained personnel in accordance with approved procedures and instructions that support essential system functionality. These processes are improving, and many aspects were performed effectively and in accordance with procedures. However, deficiencies are evident in a number of areas, such as independent verification, alarm response procedures, and normal system valve and component lineups. Similar weaknesses were identified in the 2002 and 2005 Independent Oversight inspection reports. These weaknesses indicate that fundamental aspects of the Conduct of Operations Manual have not been effectively implemented; these deficiencies were not identified by management or addressed in ongoing improvement plans. Independent Oversight team observations and reviews also indicate that personnel have inadequate knowledge of institutional procedures and programs, such as the problem identification and resolution programs and the implementation of operability evaluations. Several examples of human error demonstrated a need for improvements in the independent verification of safety-significant activities. Further, software quality assurance processes were not implemented as required for at least one WETF software application. (See Findings #E-7 through #E-9.)

Maintenance. Maintenance of essential systems at WETF has improved as a result of the LANL conduct of maintenance initiative. WETF has taken actions to better align maintenance resources and responsibilities, to better document and communicate expectations, and to enhance training on functional responsibilities. These actions have resulted in greater formality and consistency of maintenance documentation and performance, clearer integration with conduct of engineering and conduct of operations, and improvement in scheduling maintenance resources. However, WETF has not yet fully implemented the LANL maintenance implementation plan. Also, IWDs have not been sufficiently coordinated with legacy procedures, and some maintenance activities were not sufficiently planned (e.g., preparation of work packages was not complete at the time the maintenance was scheduled). Management is aware of the gaps in meeting maintenance program performance expectations and has achieved some success in improvement; however, sustained management attention is needed to continue this progress.

Procurement. Procurement programs and activities in support of safety-related system maintenance and modification are generally adequate. Procurement activities routinely involve a formally documented commercial grade item dedication. However, two procurement requests for safety-significant systems were inadequate and led to installation of parts in safety systems that were not demonstrated to be consistent with system design requirements. These deficiencies indicate that the processes have not been implemented with sufficient rigor and that DOE quality control requirements were not met. (See Finding #E-10.)

LANL Cognizant System Engineer Program and LASO Safety System Oversight

Establishment of the enhanced cognizant systems engineer program is an important improvement. However, the program is not yet fully implemented, and substantial effort is needed to ensure that it is fully developed and effectively implemented across LANL. The limitations of the cognizant systems engineer program at TA-55 are summarized above in the context of Independent Oversight's review of TA-55 corrective actions. At WETF, cognizant system engineers are not yet effectively meeting all the roles and responsibilities of that position. For instance, the cognizant system engineer function is not sufficiently integrated with other related functions, such as the surveillance programs and the preventive and predictive maintenance programs. In addition, assignment of a qualified cognizant system engineer for the WETF fire protection system is long overdue. Further, WETF cognizant system engineers did not demonstrate a full understanding of LANL procedures and expectations for problem identification, timely response, and resolution. (See Findings #E-1, #E-11, and #E-12.)

LASO's safety system oversight is ineffective and has degraded since the 2005 Independent Oversight inspection. LASO performs very little safety system oversight of TA-55, WETF, or other LANL nuclear facilities; the LASO program does not meet the requirements of DOE Manual 426.1-1A, *Federal Technical Capability Manual*. LASO oversight and coverage for laboratory nuclear facilities/safety systems is inadequate, given the large number of safety systems (approximately 90) identified by LANL. In addition, LASO has not been sufficiently involved in reviewing the completion of LANL's corrective actions to address the technical safety system engineering and safety basis issues identified during the 2005 Independent Oversight inspection. (See Finding #E-13.)

Overall Perspectives on ESF

The results of this inspection demonstrate that nuclear safety at LANL is still a concern that warrants increased management attention. The continued deficiencies at TA-55, the deficiencies identified at WETF, and recent events indicate that LANL facilities do not always meet 10 CFR 830 and DOE requirements, and that some nuclear safety risks at LANL facilities have not been sufficiently analyzed. Given the current plans, these risks may not be addressed in the near term; LANL initiatives envision a multi-year timeframe. Increased management attention is needed to accelerate enhancements in nuclear safety and to ensure that the higher risks are identified, analyzed, and addressed on a timelier basis, while still sustaining important longer-term initiatives. Particular attention needs to be focused on identifying and addressing higher-risk vulnerabilities on an accelerated schedule.

A number of challenges will have to be overcome to ensure that current risks are adequately identified, evaluated, and, where necessary, addressed through compensatory measures or near-term corrective actions. At LANL, these challenges include shortages in nuclear design expertise, nuclear safety bases evaluators, and change agents. Ineffective oversight and direction from NNSA and LASO present another challenge. A high level of LANL and NNSA/LASO management attention and support will be needed to overcome these challenges and make the needed improvements.

A number of Independent Oversight's management-level recommendations, presented in Section 6, are targeted toward management-level approaches to prioritizing available resources to address these challenges and to develop near-term actions to identify and address the most significant risks in a timely manner. Implementing these recommendations will require sustained senior management commitment, as well as the active support and involvement of NNSA and LASO.

4.3 Focus Areas

Environmental Management Implementation

LASO approved the EMS for LANL based on the site having achieved International Standards Organization (ISO) 14001 registrations. The EMS is routinely audited by a third party to ensure that ISO 14001 requirements are maintained and that necessary improvements are made. LASO provides oversight for the EMS by evaluating LANL and third-party assessments, and by meeting regularly with LANL environmental organizations; however, LASO devotes limited time in the field to evaluate line implementation. LASO drives LANL to enhance environmental performance using contract performance measures (e.g., maintaining third-party ISO 14001 registration and achieving pollution prevention performance objectives). LANL includes the EMS as part of ISM using IMP-300.4; however, implementation within the line activities has been insufficient for some work activities. LANL has established significant environmental elements and has assisted line organizations in effective implementation of the EMS by deploying environmental professionals in direct support to the Facility Operations Directors. LANL uses a set-aside fee from waste disposal to obtain funding for pollution prevention activities, including effective sitewide initiatives, for which LANL has received numerous awards. (See Findings #C-13 and #D-9.)

Specific Administrative Controls

Specific administrative controls (SACs) are administrative controls that provide preventive and/or mitigative functions for specific potential accident scenarios, and that also have safety importance equivalent to engineered controls that would be classified as safety-class or safety-significant if engineered controls were available and selected. In 2002, the DNSFB issued Recommendation 2002-3, *Requirements for the Design, Implementation, and Maintenance of Administrative Controls*, to address technical inadequacies in SACs at DOE nuclear facilities. As part of the DOE actions and commitments associated with the implementation plan for Recommendation 2002-3, DOE issued new standards to establish expectations for SACs. On January 4, 2007, DOE declared to the DNFSB that all its actions and commitments associated with Recommendation 2002-3 had been completed. However, on July 30, 2007, the DNFSB informed DOE that DNFSB reviews revealed continued deficiencies. Further the DNFSB determined that a number of major NNSA defense nuclear facilities had not yet fully implemented Recommendation 2002-3, and that DOE/NNSA line management audits and self-assessments were ineffective in determining the status of implementation. For this inspection, the Independent Oversight team reviewed the status and actions taken by NNSA Headquarters, LASO, and LANL for SAC implementation at LANL nuclear facilities. In addition, the Independent Oversight team reviewed selected SACs and a sample of surveillance procedures and results at the WCRRF and the RANT facility.

The Independent Oversight review determined that the DOE safety basis initiative is having a positive impact on SAC implementation at LANL. LANL, with support from LASO, has taken significant positive steps to correct and improve safety basis processes at LANL, such as developing a comprehensive safety basis manual that adequately addresses SACs and processes to strengthen the verification and implementation of safety-basis TSRs. However, LANL is far from achieving full implementation of DNFSB Recommendation 2002-3, and a significant backlog of safety basis upgrades needs to be addressed to bring all LANL nuclear facilities into compliance with the new SAC requirements. Independent Oversight's review of SACs at WCRRF and RANT indicates that the SACs are contributing to improvements in facility safety and are appropriate for the needs described in the safety basis. For example, SACs contribute to the safety of transuranic handling, repackaging, and transportation operations. Facility activities supporting the SACs are governed by procedures that, in most cases, effectively conveyed the applicable TSR controls. While SACs at WCRRF and RANT are generally appropriate, they contain some ambiguity from a human performance perspective. In a few cases, the ambiguity resulted in insufficient verification of appropriate implementation of SACs (e.g., a non-calibrated scale was used at RANT to weigh combustible fuel packages). The weaknesses identified by Independent Oversight are similar to those reported by DNFSB staff reviews at other defense nuclear sites, indicating a need for increased LANL and LASO focus on SAC implementation.

NNSA and LASO have recently taken some appropriate actions but previously did not provide effective direction or oversight of the efforts to enhance SACs or to ensure that the efforts to implement corrective actions for the recommendations were effective. In addition to the broader concerns about NNSA and LASO oversight, the review of NNSA and LASO identified specific concerns with the NNSA and LASO efforts as applied to SACs in three areas. First, the NNSA actions to confirm and validate field implementation of SACs were inadequate, resulting in NNSA prematurely and inaccurately declaring that actions to close Recommendation 2002-3 were complete. NNSA did not effectively analyze available information to provide an accurate assessment of the status of implementation to the Secretary of Energy and DNFSB, did not ensure that corrective actions were taken to address identified deficiencies, and did not effectively coordinate with LASO. Second, NNSA and LASO have not yet contractually required their contractors, including LANS, to follow the latest revision of the new DOE standard, which includes the new expectations for SAC implementation. Discussions with representatives of LASO and NNSA Headquarters revealed a misconception that 10 CFR 830 mandates and requires contractors responsible for nonreactor nuclear facilities to follow the latest revision of DOE Standard 3009-94 without any additional contractual actions by the contracting officer. Third, LASO's and the NNSA CDNS's efforts to evaluate SACs have not been fully effective. Although SACs have been recognized as a DOE-wide concern for some time, NNSA has provided little direction to LASO and CDNS about expectations for an oversight focus on SAC processes and their implementation by NNSA contractors. Also, LASO and CDNS were not proactive in identifying the need for a more focused evaluation

of SACs, or in developing processes and tools to systematically evaluate the effectiveness of LANL and LASO processes related to SACs. These concerns are symptoms of weaknesses in the NNSA process for managing issues to ensure that NNSA's expectations are met. (See Finding #D-1.)

Since the July 30, 2007, DNFSB memorandum to the Department expressing concerns about implementation and closure of Recommendation 2002-3, NNSA Headquarters and LASO have taken some positive steps to address the DNFSB concerns and strengthen the implementation of SACs. NNSA has developed a criteria, review, and approach document for use by NNSA site offices in performing field reviews of SACs at NNSA sites. In parallel, LASO has also developed inspection criteria, provided additional training to its Facility Representative team, and identified some shortcomings in the current guidance that need to be communicated to the responsible policy organizations for lessons learned. LASO plans to conduct its first assessment of SAC implementation in March 2008. However, increased NNSA and LASO attention to training the facility staff and performing independent verification is needed. In addition, a strategic approach to oversight is needed to ensure that the benefits of the recent actions are realized, and that LANL achieves full compliance with DOE expectations for SACs.

4.4 Feedback and Improvement Systems

NNSA/LASO

The 2005 Independent Oversight report indicated that NNSA Headquarters had not provided adequate management direction and support to ensure that longstanding deficiencies at LASO and LANL were corrected, and that LASO oversight and processes were inadequate. Accordingly, a rating of Significant Weakness was assigned to NNSA and LASO oversight. At that time, however, a number of significant improvement initiatives were under way at NNSA and LASO. Since 2005, little progress has been made in addressing the significant deficiencies in NNSA oversight or in ensuring that the needed improvements were made in LASO oversight. With some exceptions, the same problems persist today, and some aspects of LASO oversight have degraded.

The CDNS has recently performed some rigorous reviews, which confirmed that there are deficiencies in NNSA and LASO programs in the same general areas identified by Independent Oversight in 2005. With the exception of the CDNS reviews and a few activities by NNSA Headquarters staff, NNSA Headquarters oversight of LANL and LASO has been limited. NNSA does not have an adequate issues management system, has not effectively monitored LASO's progress in addressing deficiencies identified by Independent Oversight in 2005, has not provided adequate direction or support (e.g., supplemental resources) to LASO to help address the problems, and has not ensured that corrective actions were taken and were effective. The continued lack of an NNSA issues management process has also contributed to inadequacies in correction of issues identified by external organizations, such as the inadequate management of corrective action for the DNFSB recommendation regarding the use of administrative controls, which resulted in an incorrect declaration by the Secretary of Energy that actions were complete. NNSA Headquarters procedures and processes for oversight (other than CDNS) and issues management have not been established. In addition, NNSA has not 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; having a set of common processes would give site offices more time to focus on their oversight function. In 2005, at the direction of NNSA, a pilot program was established at LASO, in part to allow more focus on nuclear safety. However, the pilot program ended recently, partly because LANL still does not have a reliable contractor assurance system. (See Finding #D-1.)

With a few exceptions, LASO oversight remains inadequate, and many longstanding weaknesses have not been addressed. The exceptions are contract management and the employee concerns program, where LASO has made some improvements. However, LASO's oversight of nuclear safety has degraded since 2005, and LASO does not have an adequate safety system oversight program. Also, LASO has not fully implemented

DOE Order 226.1A and has not established an adequate and effective baseline assessment program, procedures and processes, issues management and corrective action tracking systems, and an operational awareness documentation system. Although some individual assessments were adequate, the overall process for contractor oversight is not based on a systematic plan for examining ES&H programs and providing increased attention to high-priority issues and vulnerabilities. Contractor assessments were not consistently performed or documented appropriately, and many scheduled assessments were not completed in FY 2007. LASO procedures and processes contain numerous deficiencies and, in some cases, are not fully implemented. The LASO operational awareness process lacks clearly communicated expectations for the frequency, content, quality, and rigor of documentation, and the written expectations lack requirements for LASO subject matter experts, team leads, or managers to spend a portion of their time in the field observing work. LASO continues to have difficulty in managing and tracking issues, and in closing corrective actions in a timely and effective manner. Although some improvements are evident, the LASO contract management process remains in draft, and the Independent Oversight team identified several requirements management issues (including important DOE directives that are not in the LANS contract). There are also deficiencies in the LASO self-assessment, Federal training and qualification, and Facility Representative programs. (See Findings #D-2 through #D-7.)

Overall, longstanding process and performance deficiencies in most of the major elements of NNSA and LASO oversight continue to limit NNSA's and LASO's effectiveness in driving improvements in LANL safety management. Further, NNSA and LASO do not have a coordinated and systematic oversight strategy for addressing the longstanding deficiencies regarding emphasis on priority issues, such as nuclear safety, the status of the contractor assurance system, and progress on major initiatives. NNSA and LASO senior management involvement in formulating near- and long-term corrective actions and/or compensatory measures is essential, including efforts to address staffing needs and provide staff augmentation for technical support for adequate oversight of LANL while longer-term corrective actions are in process.

LANL

LANL has established and implemented the safety assurance elements defined in DOE Order 226.1, and these elements are contributing to safer conditions and 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 and resolved, deficiencies are corrected, and lessons learned are identified and applied. Although there has been much effort to improve institutional assurance system processes and the associated requirements and guidance, some process weaknesses and insufficient and non-compliant line management implementation continue to limit the effectiveness of laboratory programs and inhibit significant performance improvement. In some cases, institutional process documents do not sufficiently define requirements, and line organizations' approaches to implementing institutional requirements and management expectations have not been fully effective. Further, the revised assurance processes lack sufficient controls and both institutional and organizational management oversight. Although training has typically been provided and feedback solicited from line and support management during development and rollout of new or revised processes, formal control mechanisms for providing timely assurance that requirements and expectations are met have not been utilized (e.g., quality reviews of management assessment plans, completed management assessments, and the management of issues). Many of the strengthened assurance program elements and senior management's expectations are still evolving, and weaknesses in processes and implementation efforts reflect an immature contractor assurance system.

Although LANL has established and implemented a comprehensive, tiered self-assessment program and conducts many ES&H-related assessment activities, weaknesses in processes and performance hinder the program's effectiveness in identifying deficiencies in the safety program and its implementation. Weaknesses include a lack of rigor in identifying activities, management systems, hazards, and risks; selecting and scheduling appropriate safety assessments; and rigorously performing and documenting assessments. (See Findings #D-8 and #D-9.)

Much attention has been directed toward developing and strengthening institutional-level goal setting and performance analysis. Many senior managers are engaged, active participants and leaders in establishing

and monitoring assurance system expectations, especially regarding the management of issues. Although LANL has established a generally adequate process and an institutional tool for managing and tracking corrective actions, the tool remains difficult to use and lacks the needed causal analysis, extent-of-condition reviews, and reporting and trending features. Although many “shadow” tracking systems have been rolled into the institutional Laboratory Issues Management and Tracking System (LIMTS), many issues are still being tracked using various other institutional and organizational tracking systems, including radiological protection, design, and engineering issues. Procedures for these systems either do not consistently address issues management elements, such as the extent of condition and cause determination/recurrence controls, or do not direct the use of the institutional corrective action management program and action tool when required. Compliant and consistent implementation, while improving, remains problematic. Action plans to address significant, longstanding safety deficiencies in numerous management systems (including findings from the 2005 Independent Oversight inspection) have not been effective and were insufficiently monitored to ensure effectiveness in a timely manner. For institutional and programmatic deficiencies identified in a number of areas during the 2005 Independent Oversight inspection, formal corrective action plans were developed and all actions completed, but the issues in some areas were not adequately resolved. Such areas included oversight and assessment, injury and illness investigations, implementation of integrated work management, employee non-compliance with requirements, subject matter expert involvement in hazard analysis and control, radiological protection programs, and potential technical deficiencies in the design analysis of certain nuclear safety systems. The Independent Oversight team identified the same or similar issues in these areas during this inspection. (See Findings #D-9, #D-10, and #D-11.)

Although LANL has established a process for reporting, investigating, and addressing occupational injuries and illnesses, significant weaknesses in both process and performance are hindering effective use of these processes to identify causes and appropriate corrective actions, to provide accurate reporting to the DOE Computerized Accident/Incident Reporting System (CAIRS), and to achieve LANL goals for reducing occupational injuries to workers. Investigations of occupational injuries and illnesses lack sufficient formality and rigor to address work control/ISM elements and accurately identify causes. External lessons learned are being screened and distributed; internal lessons learned are being generated, disseminated, and posted to the LANL website; and lessons are being incorporated into work activities. However, the documentation and dissemination of information lack important components regarding evaluations for applicability, any needed actions, and verification that the needed actions that are taken demonstrate consistent and appropriate application. Workers at LANL have many ways to express and obtain resolution of safety concerns, and the concerns that are reported are generally dispositioned adequately. However, deficiencies and weaknesses in both process and performance limit the ability to consistently demonstrate effective and timely resolution of concerns. Insufficient rigor is applied to documentation and assurance that investigations and resolutions are accurate, and that appropriate required actions are taken before closure of issues involving the employee



Construction site at LANL

concerns program and ES&H safety. Little progress has been made in addressing program deficiencies in the areas identified by Independent Oversight in 2005. (See Findings #D-9, #D-10, and #D-11.)

LANL has implemented a number of new processes and enhanced or reinvigorated some existing programs that contribute to stronger contractor assurance systems and improved safety performance. A significantly expanded, comprehensive, well-structured, and multi-tiered “balanced scorecard” of performance metrics is being constructed in a controlled and focused manner. LANL senior management has also embraced the use of the human performance improvement philosophy and techniques, including training, tools, and processes for incorporating these concepts into assurance and feedback systems. ISM/integrated work management processes are being established. LANL has also established and enhanced processes to facilitate worker-driven safety improvements, including chartered worker safety and security teams, implementation of voluntary protection program elements, a strengthened behavior-based safety observation program, and a barrier removal program to facilitate process improvement.

Although many management challenges remain in establishing, implementing, and ensuring a fully effective contractor assurance system, LANL has made some progress in improving assurance processes and implementation. Timely, continuous, and effective progress is impacted by the number and complexity of needed changes and the problems inherent in addressing ingrained cultural issues. However, LANL managers and process owners are aware of many of the weaknesses and deficiencies identified in this report and are actively engaged in addressing them. Senior managers are committed to continuous improvement and are demonstrating leadership in achieving cultural change at LANL.

5 Conclusions

With a few exceptions (e.g., the LASO employee concerns program), NNSA and LASO have made little progress in addressing the longstanding deficiencies in their oversight programs. The same problems identified in 2005 by Independent Oversight and by various other inspections and reviews are still evident. Further, NNSA and LASO do not have a realistic strategic plan for addressing the systemic deficiencies in their processes and oversight programs. The deficiencies in NNSA and LASO oversight are contributing to the continued weaknesses in LANL ES&H programs.

LANL has made progress in a number of areas, but deficiencies are still evident in many aspects of LANL ES&H and safety management programs and processes. LANL recognizes the need for changes in the safety culture and has made management and organizational changes (e.g., Facility Operations Directors) to promote such change. LANL management has also demonstrated a willingness to set aside production priorities to address safety issues (e.g., facility stand downs and outages). Through such efforts, LANL is making progress in enhancing safety at LANL in a number of areas (e.g., nuclear safety improvements at TA-55; new initiatives in work planning and control, and feedback and improvement; and effective elements of environmental management and pollution prevention).

The identified deficiencies in essential safety system functionality demonstrate that nuclear safety at LANL is still a concern that warrants increased management attention and timely additional actions. Priority attention is needed to address the significant technical design issues that have not been adequately resolved since the 2005 Independent Oversight assessment. There are continuing weaknesses in nuclear safety processes and in the institutional processes and procedures for analyzing and reporting potential concerns about the safety bases. Further, Independent Oversight's review of the WETF – a typical LANL nuclear facility that has not had the benefit of the increased management attention and pilot programs – revealed deficiencies in the safety system designs and their translation into procedures, procurement, and operations. When identified during this Independent Oversight inspection, these deficiencies prompted LANL to place the tritium gas confinement system in a safe mode (i.e., warm standby). Deficiencies in nuclear safety bases at RLWTF and site-specific administrative controls were also noted.

Although improvement initiatives are ongoing in work planning and control, and feedback and improvement, deficiencies in other important aspects of LANL ISM programs also warrant increased attention. Deficiencies in work planning and control were identified in the institutional-level processes and implementation of safety requirements at all of the organizations and facilities that were reviewed. In addition, insufficiently and inconsistently defined requirements and processes for contractor assurance system elements, insufficient corrective actions for longstanding program weaknesses and deficiencies, and insufficient rigor and oversight in the implementation of institutional assurance processes limit their effectiveness in driving substantial and continuous improvement in safety performance.

LANL senior management recognizes that much work remains to ensure that ES&H programs fully meet requirements and DOE expectations, and understands the significant challenges associated with changing behaviors at the working level, particularly with respect to shortfalls in some needed skill areas (e.g., design engineering, safety basis analyses, and budget limits/uncertainty). In some cases, LANL's plans are

appropriate and well designed to result in improvements and address root causes as part of multi-year program initiatives. However, in other cases, the plans are not sufficiently timely, considering the nature and severity of the current deficiencies, and/or plans are not sufficiently detailed (e.g., resource loaded) to provide assurance of success. Increased management attention is needed to accelerate enhancements in a number of areas (e.g., nuclear safety, work planning and control initiatives, and contractor assurance system implementation) and to ensure that the higher risks are identified, analyzed, and addressed on a timelier basis. Continued and increased LANL senior management commitment and attention will be required to achieve the needed improvements in a timely manner, while still sustaining the important longer-term initiatives.

6 Recommendations

At the request of NNSA and the LANL Director, the Independent Oversight team provides the following management-level recommendations for enhancing safety management at LANL. The recommendations below are intended to complement the detailed opportunities for improvement provided in the validation appendices, and they focus on high-priority elements and programmatic issues. Some of these issues are similar to issues identified previously in the 2005 Independent Oversight assessment and the recent CDNS review of LASO.

Recommendations for NNSA and LASO

1. **On an expedited basis, increase NNSA Headquarters involvement to ensure that LASO effectively addresses critical identified safety deficiencies.** The lack of progress by LASO and the degradation of some critical programs, such as safety system oversight and Facility Representatives, in the past two years indicate an immediate need for NNSA senior management involvement, direction, monitoring/evaluation, and support for LASO. NNSA should consider intervening to address inadequacies in LASO oversight efforts by providing or arranging for external technical and management support to provide new perspectives, helping implement proven tools, and providing needed skills on an interim basis. This approach would provide a near-term “patch” while LASO revitalizes its oversight program and would enable LASO ES&H subject matter experts, supplemented by external support, to focus on the highest priority needs for ES&H oversight (e.g., contractor assurance system, nuclear safety and safety system oversight, and effectiveness of LANL implementation of ongoing initiatives). Specific actions to consider include:
 - Increase NNSA Headquarters involvement in monitoring LASO’s progress and holding LASO accountable for correcting recognized and longstanding deficiencies in its oversight programs. Require LASO to provide frequent (e.g., monthly) progress reports to NNSA, describing efforts, progress, and problems encountered, until findings are closed and LASO has fully functional oversight processes. Ensure that a senior NNSA manager is assigned to coordinate reviews by NNSA subject matter experts and to evaluate progress, direct corrective actions, and arrange for supplemental support as needed to address problems.
 - Provide, on an interim basis, additional selected, dedicated resources from NNSA Headquarters and other NNSA site offices to augment LASO staff support in key areas that require priority attention, such as technical support to LASO Operations for processing safety basis document submittals and verifying implementation of upgraded safety bases.
 - Require the Central Technical Authority to approve and the CDNS to periodically review and evaluate site office corrective action plans for deficiencies involving site office oversight. Such reviews should be more frequent and in greater depth for sites offices, such as LASO, that have systemic and longstanding performance deficiencies. Given the significant deficiencies in the LASO oversight of

LANL nuclear safety, onsite reviews of LASO should be performed at least quarterly until LASO oversight processes are fully functional and verified to be effective.

- Ensure that the Central Technical Authority closely monitors and ensures that LASO maintains sufficient numbers of technically competent personnel to fulfill LASO ES&H oversight responsibilities, consistent with assigned functions in the NNSA *Safety Management Functions, Responsibilities and Authorities Manual* (FRAM). Where LASO has skill shortages, arrange for supplemental resources as needed from the NNSA Service Center or other sources.
- Establish a site office manager peer review process in which outside experts (e.g., previous and current NNSA Headquarters senior managers and site office managers) visit site offices on a recurring basis to monitor/mentor the site office and provide external perspectives on site office operations. In the near term, such reviews should focus primarily on site offices, such as LASO, that have systemic and longstanding performance deficiencies.
- Require CDNS staff participation in scheduled LASO internal self-assessments to provide independent perspectives on LASO internal processes and to facilitate the transfer of lessons learned from other NNSA Headquarters and site office operations.

2. Establish a position (e.g., a chief operations officer for Defense Programs) to manage and oversee integration and prioritization of infrastructure, operational, and resource issues from the NNSA corporate level. A perceived lack of support from NNSA Headquarters has been cited as a concern by LASO staff, and this Independent Oversight inspection revealed a lack of direction and expectations from NNSA. A new position could be established to provide direction to and ensure the effective utilization of NNSA Defense Program resources and focus on the development and implementation of a strategic approach to oversight. It could set expectations for site offices, monitor and evaluate effectiveness, and be the focal point for coordinating and standardizing functions (see following recommendation). It could also coordinate the application of NNSA resources (including the Service Center and subject matter experts at NNSA Headquarters and other site offices) to address NNSA's highest priority needs. The establishment of such a position would also enhance NNSA's ability to share lessons learned and successful programs/initiatives among site offices. As a first priority, the position could focus on managing and overseeing the NNSA and LASO response to the deficiencies identified during this inspection and those identified by the CDNS and other recent evaluations of NNSA and LASO. This individual must be responsible for developing and implementing an NNSA issues management process (the "how"), as required by DOE Order 226.1 (which establishes the attributes or the "what"), to ensure that corrective actions are effective in preventing recurrence.

3. Establish, where appropriate, common/standardized processes for NNSA site office operations using non-site office resources (e.g., NNSA Headquarters and Service Center) wherever feasible to increase efficiency and share responsibility for success. LASO and other NNSA site offices perform similar functions and utilize their own resources to develop and maintain redundant processes and procedures. These efforts take away time that could be spent on conducting their oversight functions. There are considerable opportunities to standardize and centralize a large number of program procedure development and maintenance efforts across NNSA and to assign major responsibilities to non-site office resources. Examples of areas that could apply such an approach include 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). Centralization and standardization efforts could be led and coordinated by the chief operating officer position (see previous recommendation). Instead of having to develop and maintain such programs, the site offices would only need to assign responsibilities for implementing the standardized processes. Further, this approach would promote consistently effective performance across NNSA site offices.

4. Establish a standard framework and expectations for NNSA line management oversight that clearly defines key line manager responsibilities and mechanisms for program implementation.

The Independent Oversight inspection of LASO in 2005 and the current inspection reveal a fundamental breakdown in performance of line management responsibilities, partly attributable to the high rate of turnover in LASO management positions. This breakdown also resulted from insufficient expectations and direction from Headquarters and was exacerbated by lack of management continuity. A standardized system to address these issues should include requirements for NNSA site offices to develop annual performance plans and perform other functions, such as developing and maintaining a three-year site office integrated oversight plan/schedule and conducting annual self-assessments against annual performance plan objectives and milestones. It should set clear expectations for annual plan objectives to include definitive performance measures and milestones and periodic reporting that target the areas requiring priority and attention. The chief operating officer position, described above, would provide the central framework for developing and implementing such a system.

5. Develop a comprehensive implementation plan that addresses all the actions needed to fully address deficiencies identified by CDNS and this Independent Oversight inspection, improve all LASO management systems and processes, and establish a comprehensive framework for continuous improvement. The deficiencies identified during previous reviews, including the 2005 Independent Oversight inspection, were not effectively addressed, and LASO does not have a viable plan for addressing the current weaknesses. To this end, near-term priorities should include the following actions:

- Develop a comprehensive oversight plan and approach to near-term priorities that include focusing on evaluating and improving LANL key management improvement initiatives, including evaluating the effectiveness of implementation of key LANL programs and initiatives. These key items include the LANL integrated formality of operations program, the LANL Safety Basis Improvement Plan, LANL work planning and control implementation, and the effectiveness of the LANL contractor's assurance system. Evaluation of such elements should include scheduled team assessments (with supplemental support as described in recommendations for NNSA above) and frequent and coordinated efforts to provide continuous monitoring and evaluation by Facility Representatives and others (e.g., subject matter expert spot checks).
- Ensure that the implementation plan is thoroughly reviewed and approved by NNSA and is a controlled document that is subject to formal change control and NNSA approval for changes.
- Ensure that processes are in place to evaluate performance and hold NNSA and LASO personnel accountable for implementing their responsibilities as delineated in the implementation plan.
- Re-evaluate of use of NNSA Service Center services to focus priority support on developing site office management systems and processes to minimize the impact on LASO's strained resources. Resources and services should be applied so as to allow LASO personnel to focus on operational awareness activities and evaluation of key LANL programs and safety improvement initiatives.

6. Take immediate and longer-term actions to establish a LASO safety system oversight program.

Independent Oversight inspections have demonstrated that the LASO safety system oversight program is inadequate and has degraded in the past two years, and that NNSA and LASO have no viable plans for establishing the required program. This deficiency is particularly significant because LANL has one of the largest nuclear operations in the DOE complex. Nevertheless, LASO has less than one full-time equivalent performing safety system oversight duties. NNSA (including the CDNS) and LASO have not implemented their responsibilities for ensuring that the safety system oversight program is staffed by a sufficient number of technically capable subject matter experts. The absence of a safety system oversight program is a vulnerability that warrants immediate management action to develop compensatory measures, as well as a longer term plan to establish a fully effective program on an accelerated basis. Appropriate actions include:

- In coordination with the implementation plan in the recommendation above, ensure that a plan for safety system oversight is developed promptly and includes effective provisions for timely compensatory measures as well as a longer-term plan for establishing a fully staffed and functional safety system oversight program.
- Identify prompt compensatory and interim measures that include reassignment of capable LASO personnel to the safety system oversight program, compensatory measures by Facility Representatives, and assignment of Service Center and/or other NNSA resources to LASO to supplement LASO staff and free up LASO staff for safety system oversight duties.
- Expedite the hiring of additional staff to support the functions of the safety authorization basis team and the Safety System Oversight Group, and continue to place a high priority on completing qualifications for the existing staff.
- Use Service Center or other NNSA personnel to the maximum extent possible to help LASO perform ancillary duties so that the current LASO staff can devote maximum time to safety system oversight responsibilities.
- Review NNSA and LASO actions in the past two years to determine why the safety system oversight program was not established, and address the root causes to prevent recurrence.
- Ensure that the Central Technical Authority (through the CDNS) and LASO management implement their responsibilities to evaluate and maintain adequate staffing. Ensure that expectations are communicated and processes are in place to hold managers accountable for performance.
- Require LASO and CDNS to report monthly on actions, progress, and problems encountered. Ensure that reports are reviewed and evaluated and that corrective actions are taken as needed.

7. Strengthen LASO performance and management involvement in line management oversight activities. Independent Oversight inspections and the CDNS review have highlighted deficiencies in performance that are attributable to insufficient line management ownership of ES&H issues and insufficient direction to ES&H subject matter experts. As a result, LASO personnel have not been working toward common goals or priorities and have not been successful in resolving identified problems in LANL ES&H performance. Improvement in this area can be achieved by:

- Setting minimal expectations/goals for both LASO managers and staff in such areas as the number of formal walkthroughs and surveillances of work activities to be performed in a given time period. Ensure that LASO first-line managers and assistant managers spend significant time in LANL facilities performing walkthroughs and monitoring and mentoring LASO subject matter experts. Set up internal tracking and reporting mechanisms to track completion of operational awareness activities.
- Targeting and scheduling LASO operational awareness activities, including functional area assessments to verify the effectiveness of key LANL programs and safety initiatives (integrated formality of operations program, LANL Safety Basis Improvement Plan, LANL work planning and control implementation, and the effectiveness of the LANL contractor's assurance system). The targeting and scheduling should provide for reviews and spot checks of major milestones for such LANL efforts (e.g., a review when LANL reports that a milestone is reached or a corrective action is complete).
- Ensure that all functional area reviews include a sample of appropriate contractor corrective actions for follow-up and evaluation of effectiveness, and evaluation of the laboratory's self-assessment program as an integral part of the scope of the area being reviewed.

8. Strengthen LASO processes and oversight activities for formal documentation, communication, and tracking of LANL performance deficiencies identified through LASO operational awareness activities. LASO has not been effective in driving improvement in contractor performance, partly because many deficiencies that LASO has identified have not been adequately communicated to LANL and/or LASO has not provided sufficient direction or follow-up (e.g., extent-of-condition reviews) to ensure that corrective actions were completed and effective. Improvement in this area can be achieved by:

- Ensuring that LASO procedures clearly and consistently establish expectations for documenting and reporting LASO activities for verification and closure of effectiveness of laboratory actions to address deficiencies/findings from all operational awareness activities. Also ensure that these expectations are captured in tracking systems so that they are readily identifiable and retrievable.
- Re-evaluating all existing informal and formal reporting mechanisms within LASO. Ensure that performance information is appropriately captured and effectively and formally communicated to both LASO and LANL management.
- Ensuring that interface protocols with LANL are clearly defined and integrated into LASO procedures and processes to formally communicate operational awareness activity results.
- Developing a formal mechanism to routinely report and update LASO management on the status of actions related to operational awareness activities.
- Developing a checklist for LASO staff to use when reviewing corrective action plan submittals and incident investigations. Such a checklist should address key issues management elements (e.g., extent of condition, root cause analysis) to ensure consistency, quality, and completeness of LASO staff reviews.
- Strengthening the formality of scheduling LASO's direct observation of selected laboratory assessments. Formal LASO reports should be developed and issued to the laboratory that critique the rigor, depth, and breadth of the LANL assessments (similar to overseeing a contractor's assessment of readiness to restart facilities).

9. Use the contract performance based incentives more effectively to promote improvement in LANL ES&H performance. While NNSA and LASO have improved their evaluation of LANL contractor performance, further enhancements can be achieved by better targeting of performance-based incentives on key issues and more results-oriented metrics for evaluating performance. Some of the current performance-based incentives need to be retargeted to indicate that many elements of the LANL ISM system, such as the contractor assurance system and cognizant system engineer program, are not mature and not yet effective. NNSA and LASO can develop performance based incentive provisions that are better designed with an understanding of the current status and priorities of the LANL ISM program. Such incentives should focus on timely and successful improvements in such key areas as timely submittal of potential inadequacies in the safety analyses, strengthening the engineering design expertise, performing credible accelerated reviews to address current vulnerabilities, effectively implementing the cognizant system engineer program, effectively implementing the contractor assurance system, and performing effective line management self-assessments. Performance-based incentives for developing programs need to focus on successfully accomplishing significant milestones and include challenging provisions for measuring "success" (e.g., performance measured by an independent inspection or by the assignment of highly qualified individuals with demonstrated expertise to key positions, such as cognizant system engineers), rather than designing a measure that simply relies on a LANL declaration that a milestone is met. Revised performance-based incentives should also focus on the quality of ES&H programs and identify indicators of program deficiencies (with a downgraded rating for repeat findings or prematurely closed corrective actions). The performance-based incentives need to be designed to better reflect the

true status of key performance areas and to promote sound decision-making focused on improvements, recognizing that LANL does not currently have mature programs and processes in key areas such as contractor assurance and safety bases.

Recommendations for LANS

- 1. Identify opportunities to accelerate current major improvement initiatives, and ensure that action plans, such as for significant safety initiatives and issues, are effectively managed by including appropriate mechanisms and controls.** Increase the use of proven project management tools and techniques for the implementation of major initiatives, and use formal monitoring and assessment methods early and throughout implementation to ensure that inadequacies in processes and implementation are identified early and corrected. This effort should include completing detailed, integrated work breakdown structure and a reliable, resource-loaded schedule for facility-specific engineering and safety activities, such as prioritized development of the full set of necessary facility-specific procedures. Progress should be monitored by senior management, and the assigned managers should be held accountable for effective performance. Rigorous effectiveness reviews should be conducted using established criteria. Place particular emphasis on evaluating and improving facility- and activity-level feedback and improvement programs as a means to promote sitewide improvement.
- 2. Address ES&H support and skill mix issues that impact ES&H programs and initiatives.** Identify methods to better utilize existing resources, and accelerate efforts to obtain additional expertise in areas of need. Identify and/or accelerate efforts to obtain/hire additional personnel who can serve as “change agents.” Identify and address barriers to the application of ES&H subject matter expertise to assist line/facility managers and researchers in hazard analysis and control.
- 3. Develop and implement a LANL plan to strengthen engineering design and safety basis evaluation functions that includes near-term and mid-term actions.** On a near-term basis, identify subject matter experts in design engineering and safety basis evaluation with the necessary nuclear experience to lead teams and mentor LANL facility and engineering personnel. Such personnel could be obtained through the LANS partner parent organization or other means (e.g., consulting contracts). Also, continue and accelerate efforts to hire LANL staff with the right types of expertise.
- 4. Expedite development and ensure implementation of a timely process for operability determinations.** Prompt determination of operability and timely response to operability concerns are essential following discovery of conditions that may not be in conformance with vital safety system design or safety basis. This process is an expected aspect of formality of nuclear safety operations. Currently, LANL’s Engineering Processes Manual PD341, Section 5.6 requires cognizant system engineers to assist in determining operability, but no formal LANL process exists for this activity; such a process needs to be established in the near future. In developing LANL’s process, consider developing a process similar to that described in Nuclear Regulatory Commission Regulatory Issue Summary 2005-20 and its attachment. Design the LANL operability determination process and training to drive the desired improvement in nuclear safety culture, and ensure that it provides a strong foundation for supporting the needed response to the many design and safety basis issues that will be identified through the cognizant system engineer initiative (e.g., walkdowns). Ensure that cognizant system engineers and other appropriate managers and facility personnel are trained on the process and understand its importance and management expectations.
- 5. Increase the use of mentoring and benchmarking to speed the transfer of knowledge and expectations for cognizant system engineer performance.** Establish a vital safety system “SWAT” team (four or five individuals) to function out of the Engineering Directorate (similar to the facility evaluation board concept) to provide mentoring and training to cognizant system engineers. Ensure that cognizant system engineers’ roles, responsibilities, and authorities are properly integrated into surveillance and maintenance processes and procedures, including signoff of resulting documents. Ensure that the safety basis initiative through the documented safety analysis upgrade and subsequent implementation plan

activities provides a framework to address full integration. Ensure that cognizant system engineers are trained and held responsible for the full scope of their roles, responsibilities, and authorities. Develop actions to promote and reward staff's attention to detail and questioning attitudes.

- 6. During the transition to full implementation of the integrated formality of operations program initiative, TA-55, WETF, and other priority facilities should devote increased attention to identifying and formalizing the necessary interim measures to ensure the highest level of safety system operability and reliability.** Facility-specific procedures and instructions and cognizant system engineer activities may not be fully implemented for a significant time period. Focus areas in the interim should include periodic safety system monitoring for operability and performance; reviewing and trending safety system problems; comprehensively screening equipment deficiencies, problems, and issues for impact on the safety basis; and formally specifying acceptance criteria (including required testing) for maintenance work. As part of the overall strategy, develop an accelerated mechanism to conduct safety system reviews with emphasis on engineering design to ensure system functionality while safety basis improvements take hold. For example, use small teams of design experts to perform reviews at each nuclear facility to identify the highest priority safety basis issues and the actions needed to address them. Obtain expertise from internal and external sources, such as the LANS teaming partner parent organizations. Use the reviews as a mentoring exercise for internal personnel.
- 7. Develop and implement a LANL plan to fully integrate the LANL work management hazard analysis process with recurring and procedurally controlled activities.** Include interim guidance on performing activity-specific job hazard analyses for activities controlled by technical procedures, with provisions for the combination of a comprehensive job hazard analysis and a technical procedure to be equivalent to an IWD.

7 Ratings

The ratings reflect the current status of the reviewed elements of LANL ISM programs.

Work Planning and Control

ACTIVITY	CORE FUNCTION RATINGS			
	Core Function #1 – Define the Scope of Work	Core Function #2 – Analyze the Hazards	Core Function #3 – Develop and Implement Controls	Core Function #4 – Perform Work Within Controls
Research and Development – Chemistry Division and Threat Reduction Directorate	Needs Improvement	Needs Improvement	Needs Improvement	Effective Performance
Facility Operations at the Environmental and Waste Management Facility Operations organizations	Effective Performance	Needs Improvement	Significant Weakness	Needs Improvement
Maintenance performed by KSL	Effective Performance	Needs Improvement	Needs Improvement	Needs Improvement

ESSENTIAL SYSTEM FUNCTIONALITY	
	Engineering Design and Authorization Basis
	Surveillance and Operations
	Maintenance and Procurement
	System Engineering and Oversight

FEEDBACK AND CONTINUOUS IMPROVEMENT - CORE FUNCTION #5	
	NNSA and LASO Feedback and Continuous Improvement Processes
	LANL Feedback and Continuous Improvement Processes

Appendix A - Supplemental Information

A.1 Dates of Review

Planning Visit	October 15-19, 2007
Onsite Inspection Visit	October 29 – November 8, 2007
Report Validation and Closeout	December 4-6, 2007

A.2 Management

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

A.2.1 Quality Review Board

Michael Kilpatrick	Bradley Peterson	Thomas Staker
Dean Hickman	Robert Nelson	Bill Sanders

A.2.2 Review Team

Thomas Staker, Team Leader			
Phil Aiken	Vic Crawford	Larry Denicola	Bob Freeman
Marvin Mielke	Shiv Seth	Bob Compton	Al Gibson
Ed Greenman	Jon Johnson	Joe Lischinsky	Jim Lockridge
Tim Martin	Joe Panchison	Larry Payne	Don Prevatte
Ed Stafford	Mario Vigliani		

A.2.3 Administrative Support

Lee Roginski	Tom Davis
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A.3 Ratings

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

- **Significant Weakness (Red):** Indicates that senior management needs to immediately focus attention and resources to resolve the identified management system or programmatic weaknesses. A Significant Weakness rating normally reflects a number of significant findings identified within a management system or program that degrade its overall effectiveness and/or that are longstanding deficiencies that have not been adequately addressed. In most cases, a Significant Weakness rating warrants immediate action and compensatory measures as appropriate.

- **Needs Improvement (Yellow):** Indicates a need for improvement and a significant increase in attention to a management system or program. This rating is anticipatory and provides an opportunity for line management to correct and improve performance before it results in a significant weakness.
- **Effective Performance (Green):** Indicates effective overall performance in a management system or program. There may be specific findings or deficiencies that require attention and resolution, but that do not degrade the overall effectiveness of the system or program.

Appendix B - Site-Specific Findings

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

FINDING STATEMENTS	
C-1	The LANL integrated work management process does not provide adequate guidance and requirements to ensure that all activity-level hazards are fully analyzed and that controls are developed for repetitive or ongoing operations and research activities, as required by LANL Institutional Policy IP-300-SD1, <i>Integrated Safety Management System Description Document with Embedded 10 CFR 851 Worker Safety and Health Program</i> , and DOE Policy 450.4, <i>Safety Management System Policy</i> .
C-2	Chemical fume hood procedures, testing, and user training lack sufficient rigor and/or adherence to ensure that the hoods are operated in compliance with LANL's and the manufacturer's requirements and applicable American National Standards Institute standards (e.g., ANSI/AIHA Z9.5).
C-3	LANL lacks institutional mechanisms to adequately address several common hazards encountered by LANL workers, such as hydrofluoric acid or nanomaterials, as required by 10 CFR 851 and DOE Policy 456.1, <i>Secretarial Policy on Nanoscale Safety</i> .
C-4	The LANL hazard communication program and cryogen program lack sufficient definition in some areas to be effectively and consistently implemented, as required by DOE Policy 450.4, <i>Safety Management System Policy</i> .
C-5	The work scopes in some research IWDs and the research change control process are not sufficiently defined to ensure that activity-level hazards and controls are adequately defined, and that infrequently-performed work is addressed in IWDs, as required by IMP-300.4.
C-6	Many worker exposures to chemical, physical, or biological hazards have not been adequately evaluated, assessed, documented, and/or communicated in both research activities and fabrication shop operations, as required by 10 CFR 851.
C-7	Radiological postings and surveys and monitoring of personnel, items, and areas at RC-1 and G Area are not sufficiently defined or implemented to ensure early detection and to prevent the inadvertent spread of contamination to clean areas, as required by LANL Implementing Support Document ISD 121-1 and 10 CFR 835.
C-8	Methods used at LANL to enroll workers in bioassay programs and prepare radiological work permits are not sufficiently developed to ensure that requirements are met and that radiological controls are adequate, as required by LANL Implementing Support Document ISD 121-1 and DOE Policy 450.4, <i>Safety Management System Policy</i> .
C-9	EWMO facilities have not ensured that all activity-level hazards are properly identified, analyzed, and controlled and that conduct-of-operations expectations are met, as required by IMP-300.4, <i>Integrated Work Management for Work Activities</i> , and the LANL Conduct of Operations Manual.

FINDING STATEMENTS	
C-10	RLWTF has not implemented a process to ensure that facility conditions and operations remain within institutional requirements and environmental permit application commitments, as required by LANL institutional procedures and DOE Policy 450.4, <i>Safety Management System Policy</i> .
C-11	RLWTF has not ensured sufficient rigor in enforcing safety requirements associated with material condition and waste/chemical storage, as required by LANL institutional procedures and DOE Policy 450.4, <i>Safety Management System Policy</i> .
C-12	EWMO has not ensured proper implementation of certain radiation protection requirements in the areas of procedure review and approval, radiological PPE, radiological postings, and contamination control as necessary to ensure adequate radiological safety, as required by LANL Implementing Support Document ISD 121-1 and DOE Policy 450.4, <i>Safety Management System Policy</i> .
C-13	The LANL MSS has not implemented the IMP-300.4 work control processes with sufficient rigor to ensure identification, analysis, and control of ES&H hazards associated with some aspects of noise, hazardous materials, physical hazards, and waste management as specified in LANL institutional procedures and DOE Policy 450.4, <i>Safety Management System Policy</i> .
C-14	Neither the LANL MSS nor KSL has established sufficient measures to ensure that KSL workers comply with ES&H requirements specified in maintenance work control documents as required by DOE Policy 450.4, <i>Safety Management System Policy</i> .
D-1	NNSA Headquarters has not implemented an adequate issues management system, as required by DOE Order 226.1A, <i>Implementation of DOE Oversight Policy</i> .
D-2	NNSA Headquarters has not implemented an employee concerns program in accordance with BOP-006.002, National Nuclear Security Administration's Employee Concerns Program, or DOE Order 442.1A, <i>Employee Concerns</i> .
D-3	The LASO contract management process lacks an approved implementing procedure (as required by the LASO FRAM), has failed to update the Contract Management Plan at least semi-annually as required, and has not ensured that Appendix G of the LANL contract was modified to include a required directive (DOE Order 226.1) and a necessary standard (DOE-STD-3009, Change 3), as required by the LASO FRAM.
D-4	LASO has not effectively implemented the requirements of DOE Order 226.1A, <i>Implementation of DOE Oversight Policy</i> , in the areas of the baseline assessment program, procedures, and processes, issues management and corrective action tracking, and operational awareness documentation.
D-5	The LASO Federal employee safety and health (FEOSH) program does not meet the requirements of DOE Order 440.1B, <i>Worker Protection Program for DOE (Including NNSA) Federal Employees</i> , in the areas of scheduling and conducting annual worker protection inspections of Federal workspaces.

FINDING STATEMENTS	
D-6	The LASO technical qualification program does not meet some requirements of DOE Manual 360.1-1B, <i>Federal Training Manual</i> , in the preparation of individual development plans, annual needs assessment, training plans, and training reports.
D-7	The LASO Facility Representative program continues to have longstanding deficiencies in training and qualification, contractor oversight and field time, and adequacy of contractor oversight and does not meet LASO Facility Representative procedures and DOE-STD-1063-2006, <i>Facility Representatives</i> .
D-8	LANL has not fully developed and implemented effective processes for self-assessment that ensure that safety processes and performance for activities, facilities, and management systems are formally identified, prioritized based on risk, and assessed at an appropriate frequency and with sufficient rigor, as required by LANL policies and procedures and DOE Order 226.1A, <i>Implementation of DOE Oversight Policy</i> .
D-9	LANL has not established timely and effective means to monitor, assess, and ensure the adequacy of implementation of new and revised contractor assurance system elements and the integrated work management program, as required by DOE Order 226.1A, <i>Implementation of DOE Oversight Policy</i> .
D-10	LANL has not fully developed or implemented fully effective processes for investigation and management of issues that result in consistent compliance with requirements and that adequately identify and address the causes and extent of condition for deficiencies, incidents, and events, as required by DOE Order 226.1A, <i>Implementation of DOE Oversight Policy</i> .
D-11	LANL has not ensured effective and timely corrective actions for longstanding and significant safety program and performance deficiencies, as required by DOE Order 226.1A, <i>Implementation of DOE Oversight Policy</i> .
E-1	The cognizant system engineer program for safety systems at LANL nuclear facilities, TA-55 and WETF, do not fully comply with the requirements of DOE Order 420.1B, and the facilities do not have interim mechanisms or compensatory measures in place to provide a high level of assurance of safety system operability, reliability, and material condition during transition to full and adequate implementation of its integrated formality of operations effort.
E-2	LANL did not adequately screen, evaluate, and resolve certain technical issues related to the TA-55 ventilation system's vulnerabilities to fire, as required by site unreviewed safety question and corrective action processes, DOE Order 414.1C, and 10 CFR 830.
E-3	WETF safety systems designs do not always completely and/or correctly reflect the performance requirements of the safety bases and/or good engineering practices, calling into question the systems' abilities to fully perform their credited safety functions, as required by site processes, DOE Order 420.1B, DOE Standard 3009, and 10 CFR 830.
E-4	WETF safety bases or actual designs have not always been completely and/or correctly translated into TSRs, procedures, and practices, as required by site processes, DOE Order 420.1B, DOE Standard 3009, and 10 CFR 830.

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E-5	In several instances, conditions in the WETF tritium gas containment system were outside established safety limits, but these conditions had not been recognized by facility staff as required by site processes, DOE 420.1B, DOE Standard 3009, and 10 CFR 830.
E-6	Documentation and analyses that demonstrate the ability of WETF safety structures, systems, and components to perform their safety functions, or that provide the basis for administrative controls, often do not exist, are not reasonably accessible, and/or are not controlled in a manner to allow confident day-to-day use in facility operations, as required by site processes, DOE Order 420.1B, DOE Standard 3009, and 10 CFR 830.
E-7	WETF has not effectively implemented a program for independent verification of safety significant activities in accordance with DOE Order 5480.19, LANL procedure IMP-315.0, <i>Conduct of Operations</i> , and ISD 315-1, <i>Conduct of Operations Manual</i> .
E-8	WETF has not established adequate operating procedures for component and system alignment checklists and alarm response procedures in accordance with DOE Order 5480.19, LANL procedure IMP-315.0, <i>Conduct of Operations</i> , and ISD 315-1, <i>Conduct of Operations Manual</i> , Sections 8.D and 16.
E-9	WETF has not implemented the software quality assurance plan for Instrumentation and Control System improvements in accordance with DOE Order 414.1C, <i>Quality Assurance</i> ; the ESA TSE-QMP; the Tritium Science and Engineering Group (ESA-TSE) Software Quality Assurance Plan, TSE-QP-13; and the Instrumentation and Control System system description document.
E-10	WETF procured and installed a 40 psid rupture disk in the tritium gas handling system and a two-stage pressure regulator in the tritium gas containment system that did not meet design requirements for these safety-significant systems, as required by DOE Order 414.1C, <i>Quality Assurance</i> .
E-11	LANL has not assigned a qualified cognizant system engineer for the safety-significant fire protection system serving the WETF hazard category 2 nuclear facility as required by DOE Order 420.1B, <i>Facility Safety</i> .
E-12	WETF did not initiate timely nonconformance report(s), did not promptly assess tritium gas handling system and tritium gas containment system operability, and did not implement compensatory measures in an expeditious manner following recognition of the installation of procured parts that did not meet or may not have met the design requirements for these safety-significant systems, as required by DOE Order 414.1C, <i>Quality Assurance</i> , and the DOE-approved LANL quality assurance program.
E-13	NNSA and LASO have not established an effective safety system oversight program, as required by DOE Manual 426.1-1A.

