Inspection of
Environment, Safety,
and Health Programs
at the

Los Alamos National Laboratory

November 2005

Office of Independent Oversight
Office of Security and Safety Performance Assurance
Office of the Secretary of Energy

OVERSIGHT

Table of Contents

Abbreviations Used in This Report

AB	Authorization Basis
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
C-AAC	C-Division Actinide Analytical Chemistry
C-ADI	C-Division Advanced Chemical Diagnostics and Instrumentation
CAIRS	Computerized Accident/Incident Reporting System
CAIS	Condition Assessment Information System
CARB	Corrective Action Review Board
CAS	Contractor Assurance System
CBDPP	Chronic Beryllium Disease Prevention Program
C-CSE	C-Division Chemical Sciences and Engineering
C-Division	Chemistry Division
CFR	Code of Federal Regulations
C-PCS	C-Division Physical Chemistry and Applied Spectroscopy
C-INC	C-Division Isotope and Nuclear Chemistry
CMMS	Computerized Maintenance Management System
CSE	Cognizant System Engineer

(Continued on Page 106 of Report)

1.0 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight (Independent Oversight) conducted an inspection of environment, safety, and health (ES&H) programs at the DOE Los Alamos National Laboratory (LANL) during October and November 2005. The inspection was performed by Independent Oversight's Office of Environment, Safety and Health Evaluations. Independent Oversight reports to the Director of the Office of Security and Safety Performance Assurance, who reports directly to the Secretary of Energy.

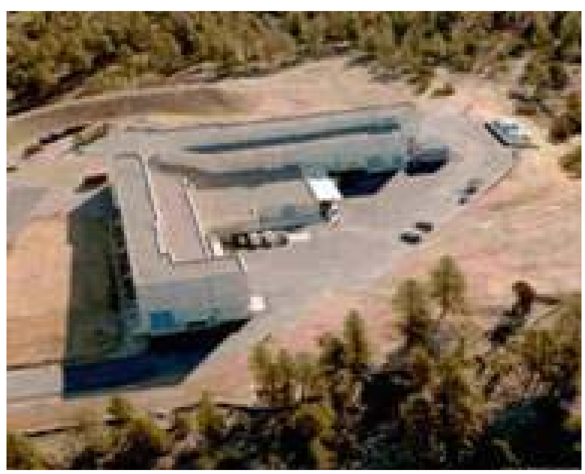
Aerial View of LANL

Within DOE, the National Nuclear Security Administration (NNSA), Office of the Deputy Administrator for Defense Programs, has line management responsibility for LANL. NNSA provides programmatic direction and funding for stockpile stewardship, facility infrastructure activities, and ES&H program implementation at LANL. As a research and development laboratory, LANL also performs projects for various other DOE organizations, other U.S. government agencies, industry, and foreign clients. At the site level, line management responsibility for LANL operations and safety falls under the Los Alamos Site Office (LASO). The NNSA Service Center is responsible for providing ES&H technical support (e.g., safety basis and specialized ES&H disciplines) and administrative support services (e.g., legal, human resources, employee concerns program, and training) to LASO in several areas in accordance with support agreements.

LANL[1] is managed and operated by the University of California. The LANL contract is currently in a competitive bid process, with a selection of a winning bidder anticipated for late in calendar year 2005. A LANL subcontractor, KSL Services, performs many of the facility maintenance activities at LANL.

LANL's primary mission is to provide scientific and engineering support to U.S. national security programs. LANL performs research, development, design, maintenance, and testing in support of the nuclear weapons stockpile. LANL also performs theoretical and applied research and development 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



TA-15: DARHT Facility

[1] Consistent with common practice, the term "LANL" is used to refer to both the physical facility and the onsite contractor management. The term "University of California" is used to refer to the University of California management that provides corporate direction to the onsite LANL management team and that performs corporate line management and evaluation functions at LANL.

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 LANL and LASO. Independent Oversight used a selective sampling approach to evaluate a representative sample of activities at LANL, including:

- LANL implementation of the core functions of integrated safety management (ISM) through its LANL integrated work management (IWM) process for selected activities, including:

  – Chemistry (C) Division, focusing on operations at Technical Area (TA) 46 and TA-48

  – Dynamic Experimentation (DX) Division, activities in TA-8; TA-9; TA-15, Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT); TA-36; TA-40; and TA-55, interface with Nuclear Materials Technology (NMT) Division

  – NMT Division, focusing on programmatic activities in TA-55

  – Facility maintenance and construction work performed by KSL in support of the applicable LANL Responsible Division Leader, focusing on work performed in TA-46, TA-48, TA-8, and TA-55.

In evaluating these activities, Independent Oversight focused primarily on implementation of ISM at the facility and activity/task levels. Independent Oversight also emphasized evaluation of recent management actions and improvement initiatives to strengthen effective implementation of the LANL IWM process.

- LANL feedback and continuous improvement systems.

- Essential safety systems, with primary emphasis on engineering and configuration management; surveillance, testing, and maintenance; and operation of ventilation and fire suppression systems at TA-55. Also reviewed were the TA-55 nuclear safety systems, which had not undergone an in-depth technical review in recent years, while nuclear safety requirements have been significantly strengthened. As part of the review of essential safety systems, Independent Oversight also selectively evaluated corrective actions being pursued by LANL and LASO for important-to-safety systems and associated engineering programs and processes.

- LASO and LANL effectiveness in managing and implementing selected aspects of the ES&H program that Independent Oversight has identified as focus areas, including the status of implementation of an environmental management system (EMS); chronic beryllium disease prevention program (CBDPP); hoisting and rigging; safety management for protective force training; and safety system oversight. Independent Oversight selects focus areas—areas that warrant increased attention across the DOE complex—based on a review of operating events and inspection results. Although these topics are not individually rated, the results of focus area reviews are considered in the evaluation of ISM core functions.

In the above areas, Independent Oversight examined LASO and LANL progress and effectiveness in developing, implementing, and verifying corrective actions for previously identified ES&H deficiencies. Independent Oversight placed particular emphasis on the deficiencies identified in Independent Oversight's April 2002 inspection and the 2004 LASO/LANL management self-assessments, which LANL performed following a July 2004 stand-down of most LANL activities.

The 2004 stand-down was directed by site management because of security and ES&H concerns. Based on direction from the Deputy Secretary of Energy, Independent Oversight deferred a planned inspection in September 2004 and instead performed an assistance review in support of the Site Office – and by extension the Laboratory contractor – to critically assess safety at LANL. Specifically, Independent Oversight inspectors worked with LASO and LANL personnel to help identify deficiencies in facility conditions, work processes and procedures, and institutional ES&H programs, as well as advising them on assessment processes, prioritizing deficiencies, and evaluating extent of condition.

During the 2004 assistance review, Independent Oversight determined that the resumption process had a positive impact on improving ES&H performance by identifying a number of areas requiring LANL management attention and action and by raising safety awareness across the site. However, it was also concluded that significant remaining efforts required management attention and priority at the highest levels of LANL, LASO, and NNSA. In particular, it was noted that sustained and continued attention would be needed to improve Site Office and Laboratory oversight and assessment processes, improve compliance with requirements and procedures, ensure that expectations are understood and implemented, improve implementation of the IWM process, and prevent recurrences of past problems.

At the 2004 assistance review, most LANL activities were undergoing validation and few had actually been approved for resumption. Since then, LANL organizations have completed their identified pre-start actions and resumed operations. However, all LANL research and support organizations are still completing a number of ongoing corrective actions in accordance with corrective action plans. In addition, a number of institutional issues – issues that span multiple organizations and/or require corrective actions at the institutional level – were identified and are being addressed through institutional processes, such as the operational efficiency project or institutional-level corrective action plans.

Sections 2 and 3 discuss the key positive attributes and weaknesses identified during this review. 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 the ES&H programs, and Section 6 presents the ratings assigned during this review. Appendix A provides supplemental information, including team composition, and Appendix B identifies the specific findings that require corrective action and follow-up.

Four technical appendices (C through F) contain detailed results of the Independent Oversight review. Appendix C provides the results of the review of the application of the core functions of ISM for work activities. Appendix D presents the results of the review of feedback and continuous improvement processes and management systems. Appendix E presents the results of the review of essential safety system functionality, and Appendix F presents the results of the review of safety management of the selected focus areas. For each of these areas, Independent Oversight identified opportunities for improvement for consideration by NNSA and contractor management. The opportunities for improvement are listed at the end of each appendix so that they can be considered in context of the status of the areas reviewed.

2.0 Positive Attributes

Several positive attributes were identified in ES&H programs, including some noteworthy communication tools.

The management self-assessment (MSA) and resumption process resulted in improvements in the LANL safety management system. Following the July 2004 stand-down of most LANL operations, each LANL division conducted one or more MSAs, which included multi-disciplinary team reviews of management, ES&H, operations, and engineering aspects of their divisions. The MSA process identified potential safety improvements, some of which were prioritized as pre-start findings and others that were included in the LANL corrective action process. Significant positive attributes of the MSA process are: (1) the identification of hundreds of opportunities for safety improvements at the work activity, group, division, and institutional levels; (2) the involvement of many LANL participants (management, researchers, and staff) in conducting intensive, independent peer reviews of work activities in areas and organizations to which they were normally not assigned; and (3) the opportunity to focus on issues central to improvements in safety, particularly since all other site activities had stopped during this period awaiting the outcome of the MSAs.

The Corrective Action Review Board (CARB) provides an effective forum for addressing local and institutional issues. The CARB provides a needed replacement of the Resumption Review Board, which was an effective means for reviewing issues during the stand-down. CARB's operations are focused on a major need at LANL, namely the quality and efficacy of corrective action plans for the many local issues discovered during MSAs and laboratory readiness reviews. The CARB's formal approach to evaluating the corrective action plans, including its use of standard Review Criteria Checklists, promotes uniformity and rigor in the review process and has the potential for ensuring that divisions' corrective action plans are based on good analyses and are comprehensive, adequate, and consistent.

LASO has provided clear expectations and incentives, and LANL has aggressively responded in establishing an EMS using a noteworthy communication tool (called "Toolkit") to aid in implementation. In coordination with LASO, LANL has established a senior EMS steering committee to drive line implementation and has opted to seek International Standards Organization (ISO) 14001 third-party certification. An EMS has been established within the LANL ISM system at the institutional level based on ISO 14001 core elements. This EMS is being implemented within the divisions using the Los Alamos National Laboratory Environmental Management System Toolkit, which is a noteworthy communication tool. In obtaining ISO 14001 certification, LANL engaged a third-party registrant to perform a four-phase audit. In the second phase, the auditors determined that because LANL's existing EMS met DOE and ISO 14001 requirements for an EMS, LANL can self-declare an EMS has been established. LANL also has an award-winning pollution prevention (P2) program that includes a funding set-aside process for waste minimization/pollution prevention projects.

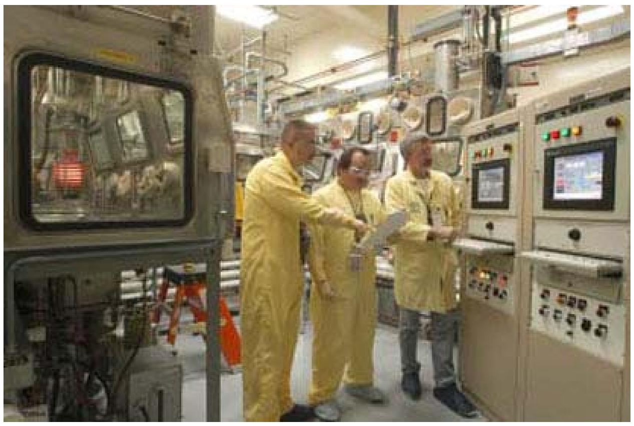
The *LANL Mirror* publication summarizing incidents, events, and lessons learned is an excellent means of sharing information about significant operational events and injuries occurring at the Laboratory and throughout the complex, along with actions taken and lessons learned. This high-quality, quarterly publication includes full color graphics, a well laid out format, and clearly written descriptions and lessons. The *Mirror* is widely distributed at various locations around the Laboratory as well as online, and the high quality of the publication assures a broad audience for communication about safety incidents and exposure to safety lessons that promote safe work behaviors.

3.0 Weaknesses

Although some aspects of the LANL ISM program are effective, weaknesses were identified in implementation of work control processes, aspects of radiation safety, configuration management for safety systems, and analysis of the technical bases for safety system parameters. There also are longstanding weaknesses in the LANL issues management system.

LANL's implementation of new work control processes and corrective actions from previous assessments have not been timely and effective. The 2004 resumption effort identified a large number of deficiencies in LANL's implementation of ISM, including institutional-level and division-level deficiencies. LANL also developed a set of corrective action plans and processes for reviewing and approving the corrective actions before closure. The resumption process led to many improvements and planned improvements in safety management. However, in the past year, many of the LANL efforts have lost momentum, have not been implemented as intended, or have not been fully effective. As a result, LANL continues to have deficiencies in a number of areas, including a number of institutional weaknesses that impact multiple divisions or that require additional corrective actions at the institutional level as well as in specific organizations. First, there are weaknesses in expectations for implementing IMP-300.2, the LANL procedure for the IWM process for work activities, and LANL's approach to initial implementation. The procedure provides an acceptable framework for a work management process, but LANL has not provided sufficiently clear expectations and milestones in all areas to ensure effective implementation across LANL. Second, several LANL divisions have not been effective in implementing the IMP-300.2 process and in meeting those requirements that were clearly defined. In several cases, divisions have applied IWM requirements incorrectly or non-conservatively. For example, IMP-300.2 gives specific requirements for use of the "qualified worker" designation as a control for specific tasks; however, several divisions have inappropriately used this designation as the only control for certain tasks or jobs, without meeting the IMP-300.2 requirements. Some divisions have stated that their IWDs comply with or are equivalent to IMP-300.2 requirements, even though their IWDs do not meet these requirements. Third, LANL has not addressed a longstanding lack of subject matter expert (SME) involvement in identifying and analyzing hazards. In each area inspected (LANL and KSL), deficiencies in hazards analyses and missing or inadequate controls were observed in areas of ES&H that are normally addressed by ES&H professionals. These include lack of baseline hazard surveys or work activity exposure assessments, industrial hygiene involvement in chemical evaluation and IWD controls for chemical exposures and noise, medical department involvement in IWD controls addressing first aid instructions for hazardous chemicals such as hydrogen fluoride, and radiation protection group involvement in review and approval of radiological work control documents.

The TA-55 nuclear facilities do not always operate with the rigor and formality required for operation of a hazard category 2 nuclear facility in fundamental areas, and LASO has not provided the necessary long-term, consistent, and effective oversight and stewardship to effect lasting improvements in all needed nuclear safety areas. A number of examples of inadequate implementation of the basic elements of safe nuclear operation were identified at TA 55. The facility lacks up-to-date diagrams for the important-to-safety systems; equipment identification numbers for all critical components; corresponding identification tags/labels permanently affixed to these components; and formal, procedurally controlled valve lineups for system operation to provide the most fundamental system configuration control. The technical safety requirement surveillances, process hazards analyses, individual work documents, and training have not completely and correctly established and implemented operational limits of the fire hazard analysis, especially in regard to combustible limits. The current authorization basis has not been adequately maintained to reflect the facility and analyses changes. Several credible accident scenarios potentially not within the envelope of the authorization basis (e.g., non-conservative analyses of system interactions for the design basis seismic event) were identified and are related to a lack of design basis failure and effects analysis. LANL does not have a functional design document control process; critical documents either do not exist or cannot be readily retrieved. The TA-55 corrective actions process has a number of significant weaknesses, and many longstanding and newly identified issues have not been entered into a corrective action system, in part, because many employees are not aware of the existence of a corrective action system.



Inside the TA-55 Plutonium Facility

LANL continues to struggle with establishing and implementing fully effective feedback and improvement processes to consistently and rigorously evaluate safety processes and performance; document, analyze, and effectively manage corrective and preventive actions; investigate injuries and illnesses to establish and implement effective recurrence controls; and identify lessons learned from safety incidents and apply them to work activities. Even as line organizations develop and implement corrective actions to address issues identified in previous self-assessments, including resumption evaluations, the existing requirements for self-assessment, issues management, and occupational injury and illness investigations are not being implemented consistently or effectively. Line organizations continue to modify institutional requirements to suit individual preferences or fail to discontinue past practices that do not comply with new institutional requirements. Required management assessments are not being performed by organizations with the highest risk profiles at the Laboratory and in such areas as nuclear safety basis and design control processes. Longstanding weaknesses have not been effectively addressed to prevent recurrence, and few internal management self-assessments of performance are performed. The causes of unacceptably high rates of occupational injuries and illnesses have not been aggressively analyzed to establish effective recurrence controls. Improvements to address known weaknesses in institutional feedback and improvement processes have been drafted, but management has indefinitely delayed approval and implementation. In some cases, the causes of and resolutions for events, injuries, and significant program implementation deficiencies have been attributed solely to inadequacies in program processes and procedures. However, root cause analyses are either not performed or do not adequately address line implementation deficiencies; thus, most or all corrective actions are assigned to the program owners, who then craft additional changes in processes and start the cycle again. These conditions and behaviors were observed in the Operational Efficiency projects, the Integrated Work Management Committee, and the management of findings from internal independent assessments. Support organizations, committees, and program owners responsible for development and oversight of safety programs and initiatives either do not have sufficient authority or have not assumed authority to effectively monitor implementation and ensure effective performance. Management has neither ensured that sufficient resources and authority are established for safety programs nor enforced established safety requirements by holding organizations and managers accountable for compliance and effective implementation.

4.0 Summary Assessment

The following paragraphs provide a summary assessment of the LASO and LANL activities that Independent Oversight evaluated during this inspection. Additional details relevant to the evaluated organizations are included in the technical appendices of this report.

ISM Core Function Implementation

LANL has made progress in some areas, such as continuing efforts to develop and implement the IMP-300.2 procedure, as a result of their efforts to address previously identified deficiencies. However, in many cases, the previous deficiencies are still evident because corrective actions are not complete, not comprehensive, or not effective. Further, there are a number of deficiencies in institutional safety management systems, including weaknesses in implementing specified IMP-300.2 requirements and a continuing lack of SME involvement in identifying and analyzing hazards.

C-Division. Significant work control accomplishments are evident in C-Division since the completion of the MSA. IWDs are numerous and, in general, adequately identify work/research tasks, hazards, and controls. The staff is knowledgeable of the hazards and controls within their workspaces, and all work observed was performed safely. Engineering controls within the C-Division laboratories are well designed and effective. However, much remains to be done. Three areas of concern identified by Independent Oversight with respect to hazard analysis are significant, particularly when considering that during the past two years C-Division has had two accidents that warranted investigations by LANL investigation teams. These areas of concern are: (1) research and shop activity-level hazards that have not been sufficiently analyzed and/or documented in IWDs; (2) area or laboratory hazards that have not been identified, communicated, or adequately managed; and (3) insufficient ES&H involvement in the identification and analysis of hazards and development of hazard controls. Of the nine judgments of need in the recent report on the Type B investigation of the acid vapor inhalation accident, which occurred on June 7, 2005, in TA-48, four were associated with the identification, analysis, categorization, and documentation of hazards. In other areas, C-Division is not fully compliant with IMP-300.2, although some aspects of IMP-300.2 may not significantly enhance worker safety for some C-Division research activities. The lack of a divisional and institutional integrated training program has resulted in some line managers not having sufficient tools to verify that workers are adequately trained prior to performing work. Some of these concerns were causal factors in recent accidents within the C-Division. A number of these concerns may require both institutional and C-Division corrective actions. All of these deficiencies had been previously identified during the C-Division MSA, recent LANL Audits and Assessment Division assessments, or the 2002 Independent Oversight inspection. However, the outstanding corrective actions from these previous assessments (in particular the C-Division MSA) are numerous and extensive, and most have not yet been completed.

DX Division. Many aspects of DX implementation of Core Functions 1 through 4 are effective. Existing work documents, project plans, and work schedules adequately define the scope of work for most current DX activities. The IWM process adequately addresses identification and analysis of hazards, and in most cases, DX appropriately implements the requirements. In most cases, appropriate controls have been established and implemented for recognized hazards. Most observed DX work was appropriately verified as ready, authorized, and performed within established controls. Although most DX hazards analyses and controls are appropriate, Independent Oversight observed a few deficiencies in LANL institutional guidance for development of IWDs, inclusion of environmental and waste management hazards in DX IWDs, performance of industrial hygiene baseline hazards surveys, and performance of work within established controls. In addition, many workers still are not aware of the benefits of the IWM process and expressed the sense that IWDs did not improve safety or, in some cases, actually decreased safety by shifting focus from safety analysis to an administrative exercise. Management attention is needed in these few areas to optimize implementation of the IWM process and ensure acceptance of the process by DX personnel.

NMT Division. NMT/TA-55 has generally robust processes and systems to plan and control programmatic work, including process hazards analysis, hazard control plans, work instructions, and IWDs. NMT has worked to maintain historical work control processes (e.g., hazard control plans) while also expending significant effort to comply with evolving institutional requirements, such as Notice 142 and IMP-300.2. Overlap and perceived duplication of information have led to continuing frustration within NMT, and the multitude of requirements has not always resulted in clear governing work authorization documents. Many aspects of hazard identification and analysis processes are effective; however, analysis of some chemical hazards and radiological hazards for non-routine isotopes, such as neptunium, is not rigorous enough to ensure the adequacy of controls. Existing hazard control plans, work instructions, and IWDs either conflict or lack sufficient detail about hazards and controls at the task level. Similar concerns were identified during the 2002 Independent Oversight inspection and 2004 MSAs. Some groups and division office management have improperly used the "qualified worker" provisions of IMP-300.2 without meeting the specific requirements and necessary institutional authorizations. While the radiation protection program at TA-55 is generally sound, deficiencies were identified in several areas, such as hazard analysis and controls in such areas as radiological work documents, radiological monitoring and surveys, and posting.

KSL Maintenance and Construction Activities. The LANL integrated work management work control process (IMP-300.2) has been improved and is adequate for controlling KSL maintenance and construction work. The IMP allows user organizations to tailor this process to suit their needs, and implementing procedures issued by the Facility Management Division provide this tailoring for work performed by KSL. However, some implementation deficiencies were observed. Potential exposures to hazardous materials are not always adequately addressed in Part 1 of IWDs, and the area hazards identified in Part 2 of IWDs are not always adequately tailored to the planned work activities. The "qualified worker" provision of IMP-300.2 was prematurely and incorrectly implemented by KSL before a supporting training program was established. Corrective actions that have been taken and planned are appropriate to address some of the identified deficiencies. The recent restriction of the qualified worker program to low-hazard activities is appropriate in view of the weaknesses in the supporting training program. The planned implementation of a systematic approach to training is needed to support application of this program to higher-hazard work. Increased involvement by ES&H SMEs is needed to assure that exposure hazards are more effectively identified and controlled, and a more effective interface between responsible division leaders and KSL is needed to better tailor area hazards to planned work. The Independent Oversight review in 2002 identified similar weaknesses in the work control process and implementation. The process has been strengthened since then, but some of the same implementation deficiencies remain. In particular, both the 2002 review and this 2005 inspection identified that some required personnel did not attend pre-job briefings, craft personnel do not always comply with work instructions, and some exposure hazards have not been adequately identified or adequately analyzed to ensure that worker exposures remain within limits.

Essential System Functionality

Significant deficiencies were identified in all functional areas that were assessed, including engineering design and analysis, the authorization bases, configuration management, corrective actions, surveillance and testing, maintenance, and operations. Although the overall designs of *most* aspects of the LANL TA-55 PF-4 facility heating, ventilation, air conditioning, and fire suppression systems are generally adequate, there are, nonetheless, significant discrepancies or voids in the designs, analyses, authorization bases, and translations of these into facility procedures and practices in both systems that could prevent or degrade the full performance of their design basis safety functions or could render them non-conservative with respect to requirements. Many aspects of configuration management at PF-4 are inadequate, including configuration documentation, system lineup controls, document control, safety basis maintenance, corrective action processes, and the unreviewed safety question process, including the process for potentially inadequate safety analyses. These weaknesses have been significant contributors to the technical weaknesses described above. Although technical safety requirement surveillances are performed on time, various inadequate testing and surveillance practices and procedures reduce the intended assurance that the facility's important-to-safety ventilation and fire suppression systems are fully capable of performing their safety functions. Some aspects of facility maintenance are adequate, including very good housekeeping and material condition, satisfactory preventive maintenance implementation, and adequate post-maintenance testing. However, other aspects of facility maintenance are less than satisfactory, including poorly implemented equipment vendor recommendations on the ventilation systems, uncertified parts routinely used in safety systems, the general lack of maintenance history, and a deficient Maintenance Implementation Plan, all of which have the potential to degrade these systems. PF-4 supervisors, operators, and technicians are knowledgeable and well qualified on the ventilation and fire suppression systems, and the qualification requirements are being updated to comply with DOE Order 5480.20. Although the operating procedures are generally adequate, ventilation system configuration control has been poor due to the absence of component lineup procedures, lack of component numbering, lack of formal control of configuration locks, outdated alarm response procedures, inadequate control of combustibles, and poor implementation of the temporary procedure change process. The weaknesses that were observed in all of these technical areas, in combination with low levels of rigor, discipline, attention to detail, and questioning attitude in implementing nuclear safety requirements, indicate a general, broad-based deficiency in the nuclear safety programs required for a hazard category 2 DOE nuclear facility at TA-55. In view of these observations, LASO's oversight and stewardship of this facility have been significantly deficient. Some of the deficiencies, including an inadequate technical basis for combustible controls, inadequate ventilation system lineup, and deficient analysis limits and technical safety requirements for fires and seismic events, warrant immediate compensatory measures. The other deficiencies warrant rigorous evaluation, including extent-of-condition reviews and identification of causal factors, on an accelerated basis to identify near-term and longer-term corrective actions that will ensure safe operation of the nuclear facility and effective implementation of safety requirements.

TA-55 Plutonium Facility Site

Focus Areas

Although a few implementation weaknesses warrant continued attention, LASO and LANL have devoted appropriate resources and management attention to the focus areas and have generally adequate programs in place. However, there are weaknesses in LASO and LANL safety system oversight.

Environmental Management System. LANL established its EMS to conform to ISO 14001 provisions and plans to self-certify its EMS in October 2005, well before the December 31, 2005, deadline. LANL is seeking certification under ISO 14001, and divisions are taking action to implement the EMS within their operations. The EMS Toolkit is a noteworthy practice for assisting in EMS implementation. The EMS at LANL, although integrated within ISM, has not yet been documented in the LANL ISM system description document. LANL's award-winning P2 program includes a funding set-aside process for P2 projects, as well as processes for reviewing new activities to identify P2 opportunities during the project planning phase.

Chronic Beryllium Disease Prevention Program. LANL has established a compliant and comprehensive CBDPP as required in 10 CFR 850. LASO has provided the necessary support, direction, and oversight for ongoing beryllium program activities, including the annual CBDPP review, the Appendix F criteria, and the CBDPP program review. The LANL program coordinator appropriately manages the CBDPP. LASO and LANL are active in promoting research and development at the Headquarters and laboratory level that could enhance the detection, containment, and safety of beryllium work and support efforts to minimize beryllium exposures.

Hoisting and Rigging. LASO has not ensured that DOE hoisting and rigging standards are included in the LANL work smart standards requirements. In addition, LANL requirements documents include incorrect and inconsistent references. As a result, some of DOE's requirements (such as requirements to examine for pinching or other conditions that could cause a failure) do not flow down to the activity level and could be missed by LANL or KSL during hoisting and rigging activities. Although requirements need to be addressed, KSL and LANL personnel who perform hoisting and rigging activities have good qualifications, and the hoisting and rigging activities that were observed were performed correctly and safely.

Safety of Protective Force Training Activities. LASO, LANL, and Protection Technology Los Alamos, Inc. (PTLA) security personnel are acutely aware of the importance of a strong safety interface for protective force training. PTLA safety documentation is extensive and is consistent with DOE Firearms Safety Standards. LASO and LANL security specialists interact with PTLA on a daily basis and are aware of the numerous safety requirements necessary for effective and safe protective force training. Live-fire range instructors are experienced and are certified as required by the DOE standard. Although no specific safety deficiencies were noted for the observed activities, the LANL/PTLA concept for dedicated industrial hygiene support for protective force training environments could address the increasingly stringent requirements for industrial hygiene at live-fire ranges.

Nuclear Safety System Oversight. The LANL contractor assurance program as applied to nuclear safety has been reactive and not effective or timely in driving needed corrective actions. Further, the cognizant system engineer program has not been effectively implemented at TA-55: leadership positions are vacant, system-specific technical training is not provided, system engineers are not knowledgeable of the technical detail of their systems, and the compartmentalization of responsibilities that exists in the organizations has inhibited the sense of overall system ownership by the system engineers that is vital to the program's success. These examples are indicative of the deficiencies in overall LANL feedback and improvement program and contribute to the significant technical deficiencies in the facility's safety systems.

LANL Feedback and Improvement Systems

The operational efficiency project, the CARB, and local corrective action plans (LCAPs) are important initiatives that contribute to LANL efforts to manage resumption issues, improve ES&H programs, and enhance safety performance. There are a number of positive aspects for each of these initiatives, such as the detailed CARB processes, and a number of accomplishments have resulted, such as LANL's conduct of operations manual. However, deficiencies were observed in all three of these initiatives. LANL management is not adequately addressing the factors that reduce the effectiveness of the operational efficiency project, such as the lack of institutional drivers and shortcomings in the verification/validation process. Additionally, although the CARB is an effective mechanism, it has not yet made substantial progress in reviewing the numerous LCAPs and institutional issues and action plans. The LCAPs also need sustained management attention at the institutional and division levels to address current weaknesses in implementation of corrective actions, including establishment of clear and timely milestones and an effective process for validating the effectiveness of the actions in addressing the original issues.

LANL has issued a contractor assurance system description document and has established and implemented a variety of fundamental feedback and improvement processes. Significant resources and efforts have been directed at cataloging, analyzing, and developing corrective action plans for the issues identified during the 2004 resumption management self-assessments. However, progress in developing and implementing the resulting corrective actions has been slow, interim or compensatory actions have often not been identified, and in some cases LANL organizations have failed to maintain compliance with existing feedback and improvement process requirements. Institutional roles and responsibilities for feedback and improvement programs have been better defined, and process oversight has been assigned to a new Performance Surety division. However, authorities for ensuring effective implementation of these programs are not clearly understood or exercised, and LANL management has not held organizations and managers accountable for effective implementation. In general, although safety problems are being identified and addressed and progress is being made in addressing known safety program issues, minimal improvement has been made in most feedback and improvement processes, and performance since the Independent Oversight inspection in 2002 has degraded in the area of management assessment. Significant revisions in feedback and improvement requirements and process documents have been drafted and a new issues management tracking tool has been acquired, but LANL management has suspended the issuance of these new documents pending selection of the successful bidder for the new prime contract (scheduled for December 2005). Delays in the development and issuance of these improved institutional management system documents could adversely affect continuous improvement in safety performance at LANL.

5.0 Conclusions

Some elements of the ISM program at LANL are effective and/or improving. For example, the development of a sitewide work control process is a significant accomplishment that provides the framework for improvements. LASO and LANL have addressed the complex issues associated with EMS and CBDPP implementation. Although process weaknesses remain, many of the controls in place for high-hazard activities at the organizations that Independent Oversight reviewed provide appropriate protection of workers, the public, and environment. For example, engineering controls are used extensively for radioactive and chemical hazards. In addition, some aspects of the LANL feedback and improvement program are improving; these include the LANL internal independent assessments, which have identified many of the same issues that Independent Oversight identified during this inspection.

However, longstanding weaknesses in LANL processes have been repeatedly identified but have not been adequately addressed. Weaknesses in the IWM process and its implementation resulted in situations where hazards to workers had not been adequately identified, analyzed, and controlled. LANL injury and illness rates are among the highest in the DOE complex. In addition, because of weaknesses in safety bases, LASO and LANL cannot demonstrate that the safety systems at TA-55 will perform their required safety functions in all normal and accident conditions. There are also longstanding weaknesses in many aspects of LANL feedback and improvement systems, including LANL management assessments, issues management, and injury and illness reporting. Improvements in issues management processes are key to achieving the needed improvements in safety management across LANL activities and safety systems, but LANL's efforts to improve in these areas have not been sufficient or effective.

LASO and LANL have recognized some of these implementation weaknesses and have taken or initiated some appropriate actions for individual problems. However, the improvements resulting from the resumption effort have lost momentum because of underlying issues that hinder timely and effective resolution of longstanding weaknesses. These underlying issues include:

- LANL has not established sufficient institutional drivers that require timely implementation of some of the important institutional initiatives. For example, LANL did not ensure that divisions developed adequate implementation plans and upgraded their processes and IWDs to fully meet IMP-300 requirements.

- LANL management has not devoted sufficient attention to establishing a clear chain of responsibility and accountability for corrective actions that extends from the institutional to the division, facility, and activity levels. In a number of cases, milestones have been missed, pre-start issues have recurred, corrective actions have been delayed or not completed, and/or corrective actions have not been verified to be effective.

- LANL does not have rigorous processes for the Operational Efficiency Project Integrated Product Team Leaders to determine or verify the effectiveness of elements implemented by the divisions or by organizations within divisions.

Many of the weaknesses identified during this Independent Oversight inspection are similar to weaknesses identified by previous assessments, including the MSAs, previous Independent Oversight inspections, LASO assessments, and other reviews. LANL needs to use its corrective action management processes effectively to evaluate and prioritize the deficiencies identified during this inspection and ensure that corrective actions are coordinated with other ongoing corrective action plans. However, at the senior management level, three broad areas warrant high management priority and sustained attention:

- Clarifying the direction, expectations, and accountability for implementing IMP-300.2 and other safety management processes and improvement initiatives, including a clear chain of direction and accountability that extends from the LANL Director through the various divisions and down to the individual researcher/worker

- Establishing a systematic approach to addressing the longstanding issues with respect to nuclear safety systems, such as the lack of a current documented safety analysis, supporting analyses, and technical safety requirements; such an approach would include implementing immediate compensatory measures and developing a comprehensive documented safety analysis for TA-55

- Enhancing and effectively implementing the corrective action management process, including clear assignment of responsibilities, accountability for performance, and effective verification of effectiveness to ensure that corrective actions are comprehensive and effective.

6.0 Ratings

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

Implementation of Core Functions #1 – #4 for Selected Work Activities

LANL ACTIVITY	CORE FUNCTION RATINGS			
	Core Function #1 – Define the Scope of Work	**Core Function #2 – Analyze the Hazards**	**Core Function #3 – Identify and Implement Controls**	**Core Function #4 – Perform Work Within Controls**
Chemistry Division	Effective Performance	Significant Weakness	Needs Improvement	Effective Performance
Dynamic Experimentation Division	Effective Performance	Needs Improvement	Needs Improvement	Effective Performance
Nuclear Materials Technology Division	Effective Performance	Needs Improvement	Needs Improvement	Effective Performance
Facility Maintenance and Construction Work Performed by KSL	Needs Improvement	Needs Improvement	Effective Performance	Needs Improvement

Essential System Functionality

Engineering Design .... SIGNIFICANT WEAKNESS
Configuration Management .... SIGNIFICANT WEAKNESS
Surveillance and Testing .... SIGNIFICANT WEAKNESS
Maintenance .... NEEDS IMPROVEMENT
Operations .... NEEDS IMPROVEMENT

Feedback and Improvement - Core Function #5

LANL Feedback and Continuous Improvement Processes .... SIGNIFICANT WEAKNESS

APPENDIX A
SUPPLEMENTAL INFORMATION

A.1 Dates of Review

Planning Visit	September 26 – 30, 2005
Onsite Inspection	October 11 – 20, 2005
Report Validation and Closeout	November 8 – 10, 2005

A.2 Review Team Composition

A.2.1 Management

Glenn S. Podonsky, Director, Office of Security and Safety Performance Assurance
Michael A. Kilpatrick, Deputy Director for Operations, Office of Security and Safety Performance Assurance
Patricia Worthington, Director, Office of Environment, Safety and Health Evaluations
Thomas Staker, Deputy Director, Office of Environment, Safety and Health Evaluations

A.2.2 Quality Review Board

Michael Kilpatrick	Patricia Worthington
Dean Hickman	Robert Nelson

A.2.3 Review Team

Patricia Worthington, Team Leader

Vic Crawford	Robert Freeman	Ali Ghovanlou	Mike Gilroy
Marvin Mielke	Bill Miller	Robert Compton	Al Gibson
Joe Lischinsky	Jim Lockridge	Tim Martin	Joe Panchison
Don Prevatte	Michael Shlyamberg	Ed Stafford	Mario Vigliani

A.2.4 Administrative Support

MaryAnne Sirk	Keiana Scott	Tom Davis

A.3 Ratings

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 senior management needs to immediately focus attention and resources necessary to resolve management system or programmatic weaknesses identified. A significant weakness rating would normally reflect 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. A significant weakness rating would, in most cases, warrant 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	PAGE
1. LANL has not provided adequate expectations, guidance, and tools to ensure timely and effective implementation of the new integrated work management process.	20
2. Some LANL divisions have not adequately implemented IMP-300.2 and/or ensured that existing work control processes meet the minimum requirements established by IMP-300.2.	20
3. LANL line management has not provided an effective mechanism to ensure appropriate ES&H SME involvement in developing activity-level hazards analyses and controls.	21
4. Some LANL C-Division research and shop activity hazards have not been adequately addressed within IWDs or sufficiently analyzed to allow the appropriate hazard controls to be identified and implemented.	23
5. When multiple LANL groups and/or divisions occupy the same laboratory, there is no mechanism to ensure that potential hazards and controls are shared among all occupants, and that one person or group has responsibility and authority for activities conducted within the space.	23
6. LANL C-Division lacks a structured process for mentoring and qualifying researchers and shop staff to operate high-hazard equipment before performing work.	26
7. Training programs applicable to LANL C-Division, at both the institutional and division levels, are not adequately structured and integrated to ensure that training requirements and controls important to worker safety are identified and verified before work is performed.	27
8. Potential radiological hazards posed by neptunium and isotopes other than plutonium, americium, uranium, and tritium are not adequately addressed by existing LANL TA-55 hazards analysis processes or HSR mechanisms.	35
9. LANL NMT radiological work control documents, such as HCPs and work instructions, do not contain all required radiological information and are not reviewed or approved by HSR-1 as needed to ensure that workers are properly informed of radiological conditions.	38
10. LANL NMT line management and HSR have not ensured that sufficient radiation surveys are performed during work that involves changing radiological conditions to ensure that workers are aware of radiological conditions and can effectively minimize exposures.	38
11. KSL has not ensured that potential exposures to hazardous materials are adequately identified or analyzed as required by DOE Order 440.1A.	43

Table B-1. Site-Specific Findings Requiring Corrective Action (continued)

FINDING STATEMENTS	PAGE
12. LANL has not established and implemented a fully effective management self-assessment program that ensures that safety programs and performance are routinely and formally evaluated.	60
13. LANL has not established and implemented a fully effective corrective action program that ensures that safety deficiencies are appropriately documented, rigorously categorized, and evaluated in a timely manner, with accurate identification of root causes, extent of condition, and appropriate recurrence controls.	63
14. The LANL injury and illness program lacks sufficient rigor to ensure that incidents are consistently reported to supervision and sufficiently documented, that root causes are identified, and that effective corrective and preventive actions are identified, documented, and implemented.	65
15. Technical deficiencies in the designs of the LANL PF-4 important-to-safety HVAC and fire protection systems, in their authorization bases, and in the translation of these designs into facility procedures and practices significantly compromise or call into question these systems' ability to fully perform their safety functions.	77
16. Fundamental elements of configuration management, such as accurate documentation of system configurations, control of system lineups, control of design documentation, and control of the current safety basis, are significantly deficient in LANL TA-55.	79
17. For TA-55, LANL has instituted an inappropriate practice of screening out generic change types involving SSCs described in the FSAR based on previous negative generic USQDs for those change types, thereby circumventing the screening and determination requirements of the USQ procedure and 10 CFR 830.	80
18. LANL USQ screenings at TA-55 are not performed in accordance with the requirements of the site USQ procedure and 10 CFR 830, so that most changes do not undergo the required USQ evaluations.	81
19. Several LANL TA-55 TSR surveillances for the important-to-safety ventilation and fire suppression systems do not meet 10 CFR 830 requirements in such areas as specific system alignments for all modes of operation and specific and unambiguous surveillance limits supported by documented technical bases.	83
20. LANL has not implemented or documented exceptions to the vendor manual recommendations in the maintenance procedures for the PF-4 important-to-safety ventilation systems.	85
21. LANL has not rigorously documented and certified in work packages the use of Management Level 2 purchased material as replacement parts in important-to-safety systems at PF-4, potentially degrading these systems.	85
22. The LANL Maintenance Implementation Plan for TA-55 does not always accurately describe current implementation with respect to known deficiencies and does not provide clear implementation planning milestones and supporting details.	85

Table B-1. Site-Specific Findings Requiring Corrective Action (continued)

FINDING STATEMENTS	PAGE
23. LANL TA-55 operations are deficient is some areas, including the lack of approved system lineup procedures for some important-to-safety systems, lack of some periodic lineup verifications, lack of control of configuration locks, out-of-date ventilation alarm response procedures, and poor implementation of the temporary procedure change process.	87
24. LASO and LANL have not ensured that DOE hoisting and rigging requirements accurately flow down to LANL workers and subcontractors.	98
25. LANL/NMT has not sufficiently defined and implemented an integrated approach to nuclear safety assessments and corrective actions that ensures that line management adequately addresses and resolves deficiencies in nuclear safety systems in a timely manner.	102
26. LANL has not fully instituted an effective cognizant system engineer program at TA-55 that ensures that system engineers are fully knowledgeable about the technical details/bases of their systems, including the authorization bases, interaction with supporting control systems, technical manuals, and associated system performance criteria and supporting calculations.	103

APPENDIX C
CORE FUNCTION IMPLEMENTATION (CORE FUNCTIONS #1 – #4)

C.1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight (Independent Oversight) evaluated work planning and control processes and implementation of the first four core functions of integrated safety management (ISM) for selected activities at the Los Alamos National Laboratory (LANL). The Independent Oversight review of the ISM core functions focused on environment, safety, and health (ES&H) programs as applied to selected aspects of LANL activities:

- Chemistry (C) Division, focusing on operations at Technical Area (TA) 46 and TA-48—see Section C.2.1
- Dynamic Experimentation (DX) Division, focusing on activities in TA-8; TA-9; TA-15, Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT); TA-36; TA-40; and TA-55, interface with Nuclear Materials Technology (NMT) Division—see Section C.2.2
- NMT Division, focusing on activities in TA-55—see Section C.2.3
- Facility maintenance work performed by KSL under the applicable LANL responsible division leader, focusing on maintenance work performed in TA-46, TA-48, TA-8 and TA-55—see Section C.2.4.

For each area, Independent Oversight reviewed implementation of the integrated work management (IWM) process (which is the LANL system for implementing ISM in work activities), observed ongoing operations, toured work areas, observed equipment operations, conducted technical discussions and interviews with managers and technical staff, reviewed interfaces with ES&H staff, and reviewed ES&H documentation (e.g., plant standards, permits, and safety analyses).

C.2 Results

In addition to evaluating the selected LANL activities, Independent Oversight also evaluated the collective results of the application of Core Functions #1 through #4 in the selected activities to identify commonalities and factors that contribute to the identified deficiencies. As discussed below, the evaluation of the collective results identified three work planning and control findings that warrant institutional-level attention. These findings were evident across multiple facilities and activities that were evaluated on this inspection and may also apply to other LANL facilities and activities that were not included in the scope of this inspection. These findings are presented below for easy reference. Additional observations contributing to these findings are discussed and referenced in the results section for each of the activities reviewed (Sections C.2.1 through C.2.4).

The first finding reflects weaknesses in LANL's approach to initial implementation of IMP-300.2, the LANL procedure for the IWM process for work activities. The procedure provides an acceptable framework for a work management process, but LANL has not provided sufficiently clear expectations and guidance in all areas to ensure effective implementation across LANL. During this inspection, difficulties in implementation were evident in all areas reviewed, including KSL (the maintenance and construction contractor). Specific problems included incorrect application of risk levels and misunderstanding of the purpose and use of standing integrated work documents (IWDs). Additionally, the procedure provides implementation milestones, but LANL has not provided an implementation plan, a pilot program, or a method to easily integrate improvements from feedback from the field. Confusion and lack of acceptance of the process by both workers and line managers exacerbates these problems.

The Operational Efficiency Project Team and the Integrated Work Management Committee (IWMC), as described in its charter, have the responsibility to monitor and facilitate implementation of the IWM process. However, their efforts have been insufficient to ensure timely and effective implementation. Although the Operational Efficiency Project Team has incorporated some controls into their project execution plan, such as conducting a management self-assessment (MSA) to assess achievement of its mission and the development of project implementation plans by each directorate to detail the implementation of the scope of operational efficiency projects, these controls have not been implemented. No formal MSAs have been performed by the operational efficiency project, and the directorates have not developed formal implementation plans. Although the project has established some high-level milestones for each sub-project, they do not include sufficient monitoring and assessment. Many of these problems were identified early in the implementation process by various methods, including a LANL Audits and Assessment Division assessment of IWM issued in May 2005. Although the IWMC charter addresses many of the issues, the IWMC has taken minimal action to modify the process or revise the procedure to correct the identified problems.

Finding #1. LANL has not provided adequate expectations, guidance, and tools to ensure timely and effective implementation of the new integrated work management process.

Notwithstanding these deficiencies in IMP-300.2 implementation, IMP-300.2 does provide clear requirements in several areas and an acceptable method of performing activity-level IWM. The second institutional finding reflects weaknesses within several LANL divisions in implementing the process and meeting the requirements that are clearly defined. In several cases, divisions have applied IWM requirements incorrectly or non-conservatively. For example, IMP-300.2 gives specific requirements for using the "qualified worker" designation (a "qualified worker" is a LANL process for identifying specific tasks that can be performed through skill of the craft and/or without a detailed procedure) as a control for specific tasks; however, several divisions have inappropriately used this designation to eliminate the need for IWDs without meeting the IMP-300.2 requirements. In another example, IMP-300.2 provides specific requirements for activity-specific and work-area information that all IWDs must meet (Part 1 and Part 2 requirements). Some divisions have stated that their IWDs are compliant with or equivalent to IMP-300.2 requirements, even though their IWDs do not meet these specific IMP-300.2 requirements.

Some Independent Oversight observations reflect deficiencies in the LANL institutional training, requirements, and guidance for the IWM process. For example, LANL has not effectively conveyed the purpose and benefit of the IWM process to employees. Interviews with workers and supervisors indicate that many employees believe the new IWM process does not add to worker safety, and in some cases, they believe that activities are now less safe because of the perceived change in focus from evaluating safety to completing IWD paperwork. Similar concerns were identified by Independent Oversight in C-Divison and have been identified in the past by internal and external assessments of LANL. For example, a May 2005 LANL internal assessment by the Audits and Assessments organization found that 48 percent of workers indicated that IWDs did not improve safety. However, no corrective actions have been identified, documented, or implemented. (See Finding #1 and Appendix D.)

Finding #2. Some LANL divisions have not adequately implemented IMP-300.2 and/or ensured that existing work control processes meet the minimum requirements established by IMP-300.2.

The third institutional finding reflects a continuing lack of subject matter expert (SME) involvement in identifying and analyzing hazards. In each area inspected (LANL and KSL), deficiencies in hazards analyses and missing or inadequate controls were observed in areas of ES&H normally addressed by ES&H professionals. Deficiencies included a lack of baseline hazard surveys; infrequent worker activity exposure assessments; and insufficient industrial hygiene, industrial safety, radiation protection, environmental protection, and medical involvement in the identification of hazards and hazard controls for higher-risk work activities (e.g., IWD hazards and controls for chemical exposures and noise, medical department involvement in IWD controls addressing first aid instructions for hazardous chemicals such as hydrogen fluoride, and radiation protection group involvement in radiological work control documents). LANL institutional requirements place the responsibility for determining SME involvement on line management; however, line management sometimes does not recognize the need for a given safety discipline, and institutional requirements are not sufficiently detailed to ensure the appropriate review in all cases. This concern is particularly troublesome because it has been a longstanding issue at LANL and has a direct effect on worker safety and protection from workplace hazards. Similar findings were reported in the 1999 follow-up review of ISM at the Los Alamos Neutron Scattering Science Center (LANSCE) and the 2002 Independent Oversight inspection.

Finding #3. Line management has not provided an effective mechanism to ensure appropriate ES&H SME involvement in developing activity-level hazards analyses and controls.

It is important that LANL evaluate and address the institutional findings at each applicable facility/ activity and perform an extent-of-condition evaluation for the entire laboratory. The corrective actions need to include both institutional and facility/activity-specific corrective actions and address all of the individual concerns that are referenced to a specific finding.

C.2.1 Chemistry Division Core Functions #1 – #4

The mission of the Chemistry Division (C-Division) within LANL is to provide ongoing state-of-the-art strategic chemical research related to national and homeland security, nuclear weapons, isotope science, applied energy, and nanoscale science and engineering. Major work groups within C-Division include Actinide Analytical Chemistry (C-AAC); Chemical Sciences and Engineering (C-CSE); Isotope and Nuclear Chemistry (C-INC); Physical Chemistry and Applied Spectroscopy (C-PCS); Actinide, Catalysis and Separations Chemistry (C-SIC); and Advanced Chemical Diagnostics and Instrumentation (C-ADI).

This Independent Oversight inspection focused on research and development and routine work activities within the C-Division being conducted at TA-48 and TA-46. Five of the seven C-Division groups were sampled during this inspection. Work activities were sampled within two C-Division groups at TA-48 (C-SIC and C-INC), and three C-Division groups (C-CSE, C-ADI, and C-PCS) at TA-46. In this process, work documents were reviewed, managers and researchers were interviewed, and laboratory operations and workspaces were observed to assess the application of the safety management core functions. Approximately 15 activities were observed from these five C-Division groups. The observations from this review are presented in the following paragraphs.

Status of Corrective Actions

Although not specifically inspected by Independent Oversight in 2002, C-Division used the LANL safe work practices process in 2002, which was determined to have a number of deficiencies during the 2002 Independent Oversight inspection. The current C-Division local corrective action plan (LCAP) (Rev 1, June 2005) has incorporated the results of the C-Division Risk-Level 2/3 MSA with the corrective actions from the May 2004 readiness assessment of TA-48 and the accident investigation from the July 14, 2004, laser accident at TA-46. Corrective actions from the most recent Type B investigation of the acid vapor inhalation accident on June 7, 2005, in TA-48 have yet to be developed and incorporated into the LCAP. The MSA resulted in 32 pre-start findings and substantive observations, and 166 post-start findings and substantive observations. C-Division addressed the pre-start findings before resuming operations and then combined the remaining findings and substantive observations into 18 work breakdown structure (WBS) elements that are being tracked through closure in the LANL I-Track System.

Since late 2004, C-Division has implemented a number of corrective actions that have improved the safety of research and shop activities within C-Division facilities. For example, the C-Division Laser Safety Policy has provided clarification and additional guidance on implementing American National Standards Institute (ANSI) Z136.1, which was not adequately addressed in the institutional laboratory implementation requirement (LIR) and laboratory implementation guide (LIG) on laser safety. However, most of the C-Division corrective actions, as identified in MSAs, LANL assessments, and corrective actions for C-Division incidents, have not been completed. Some are not scheduled for completion for two to four years, and adequate interim corrective actions are not assigned in some cases. Currently, all of the remaining C-Division corrective actions are classified as "low significance," which is not appropriate for some corrective actions. Furthermore, of those corrective actions that have been completed, a few have not been fully effective in resolving the initial concerns. (See Finding #13.)

Core Function #1: Define Scope of Work

In general, the evolving IWM process has resulted in research and shop work descriptions that are well defined in IWDs, hazard control plans (HCPs), and procedures. Most of the C-Division IWDs provide a summary description of the research or work activity that is sufficient to identify the scope and boundaries of the activity. Most of the IWDs have also been tailored to the work activity and describe the work in sequential tasks in order to link the hazards and controls to the work activity. Hundreds of IWDs have been issued and are kept current within C-Division. For example, 15 IWDs have been prepared for the C-ADI machine shop in TA- 46, Building 31. The large number of IWDs is attributed to the diverse nature of the equipment within the shop (i.e., one IWD per machine).

An HCP and one or more standard operating procedures (SOPs), which also define the work activity, supplement the IWDs for many C-Division work activities. The C-Division HCPs, which resulted from a process that was in use before LANL's development of the IWD process and then were used concurrently with IWDs, may eventually be eliminated from the IWM process, and some HCPs will no longer be maintained. However, the HCPs contain a significant level of information and detail about the research that would not be contained within the IWD—for example, an HCP and an SOP supplement the IWD for titanium hydride (TiH_2) sieving. Collectively, these three documents provide a comprehensive description of the work activity.

Summary. Research and work activities within the C-Division are well defined in hundreds of IWDs, HCPs, procedures, manuals, research notebooks, technical papers, and operator aids.

Core Function #2: Analyze Hazards

In general, the IWM process has been effective in identifying, analyzing, and documenting many hazards associated with C-Division research and development work activities. For example, the hazards and controls for laser-induced breakdown spectroscopy in TA-46, Building 41, are well documented within the IWD. The IWD for the solvent dispensing process in TA-48 (Kingdom area) contains detailed work steps, hazards, and controls that eliminated transporting chemicals by hand throughout the laboratory area. Furthermore, most C-Division IWDs reference one or more HCPs. In general, HCPs are robust hazards-analysis documents that often include a detailed "Hazop" or "What-If Checklist" matrix to identify and analyze the hazards associated with each step of the research activity.

In some cases, however, C-Division IWDs do not rovide enough information about workplace hazards to allow identification of the appropriate hazard controls. For example, the IWD for the TA-48 hot cell staff machine shop does not sufficiently identify potential hazards associated with noise, various cutting fluids, and silica-containing abrasives that are available for use in the machine shop. In another example, the IWD for radioactive material handling for transuranic structural and environmental chemistry, performed at TA-48 in the RC-1 facility by the C-SIC group, does not provide enough specific hazard information to allow workers to readily identify the appropriate hazard controls. This IWD requires the worker to obtain the material safety data sheet (MSDS) and select the appropriate chemical glove without sufficient guidance for chemical glove selection. For this example, the IWD refers workers to glove-chemical compatibility guides (i.e., ChemWatch). In a further example, in the IWD for radioactive standards preparation used at TA-48 RC-1, C-INC specifies three types of gloves as personal protective equipment (PPE). However the IWD does not link a specific glove type to the activity. In the case of using acid solutions mixed with acetone, two of the three gloves listed would not provide adequate worker protection. Similar concerns were also identified in a May 2005 LANL Audits and Assessment Division assessment on IWM, which determined that "hazards were missing from IWDs, and therefore were not analyzed." (See Finding #4.)

In a few cases, some C-Division work activity hazards that were identified by the Independent Oversight team had not been adequately analyzed. For example, the potential explosion hazards for handling TiH_2 during material certifications was not sufficiently analyzed to ensure that material conditions in one sieve tray could not result in an explosion. Furthermore, there was no documented analysis to verify that conditions would not be present such that "finely divided powder may ignite spontaneously," as stated in the TiH_2 MSDS. As a result of these concerns, a work pause was initiated by C-Division line management. In a second example, some carcinogenic metals are used in the TA-46, Building 31 machine shop (e.g., nickel welding rods) for which the hazards have not been analyzed, and the appropriate controls (e.g., door postings and completion of the Category 1 Chemical Form 1600) have not been implemented. In a third example, the potential concern with the inadvertent release of hazardous gases in Room 34, Building 24, TA-46 that had the potential to exceed the threshold limiting values (TLVs) had not been analyzed. (i.e., C-CSE Compressed Gas Certification). Within the room there were over 20 compressed gas cylinders, some of which were being tested, others of which were either awaiting testing or were calibration gases used for the instruments. During routine operations, limited quantities of impurity gases (e.g., H_2, O_2, methane, and CO) are intentionally released into the room from purging the cylinders or the instruments. As a result of recent security upgrades, the room has also been made "tighter," and normal ventilation pathways (i.e., through the door) have been restricted. The IWD for this activity limits gas bottles to less than 200 ppm of a compound that may be hazardous. However, for some gases (e.g., CO) this 200 ppm limit is well above the TLV limit (i.e., 25 ppm for CO). There are no alarms or gas monitoring equipment in the room to indicate whether oxygen levels are depleted, or whether some hazardous impurity gas (e.g., CO) has been released in concentrations that exceed the TLV. On occasion, workers may also work alone in the room without notifying others.

Finding #4. Some LANL C-Division research and shop activity hazards have not been adequately addressed within IWDs or sufficiently analyzed to allow the appropriate hazard controls to be identified and implemented.

In a number of work observations by the Independent Oversight team, area-level hazards were not sufficiently identified and communicated among the various work groups in the same workspace. For example, electrical contractors conducting Project Management Division-directed fire alarm system upgrade work in TA-48 RC-1 were observed using high noise generating equipment (e.g., hammer drills and core drills) without an adequate assessment of potential noise hazards to themselves or co-located C-Division researchers. In a second example, within the C-CSE Industrial Hygiene Analytical Lab (TA-59), KSL is currently in the process of installing a new laboratory sink. However, there has been no formal identification and exchange of hazard information between the KSL mechanics and the C-CSE analysts. In a third example, electrical contractors conducting the alarm system upgrade work at TA-48 RC-1 were working in areas of the TA-48 RC-1 hot cell facility that are not routinely occupied or surveyed, possibly resulting in unmonitored contamination or the spread of contamination; these areas have not been radiologically surveyed for legacy contamination. Two additional examples of area hazards not being identified or communicated are provided at the end of the section on Core Function #3, below. The C-Division MSA recognized the concerns associated with multiple hazards in workspaces that are occupied by different groups. One of the MSA corrective actions to address this concern was to establish a Space Point of Contact (SPOC). However, the SPOC was established via a Standing Order from a previous C-Division Director whose Standing Orders were cancelled upon his departure. The establishment of the SPOC was also a C-Division MSA Pre-Start Substantial Observation (Pre-Start Observation No. 21/04-7.01-SO3). Additional comments on this concern are also discussed under Core Function #3.

Finding #5. When multiple LANL groups and/or divisions occupy the same laboratory, there is no mechanism to ensure that potential hazards and controls are shared among all occupants, and that one person or group has responsibility and authority for activities conducted within the space.

Another concern within C-Division is the lack of sufficient involvement of ES&H SMEs, such as industrial hygiene, industrial safety, and medical, in the identification and analysis of hazards and in the preparation or review of IWDs for research activities and shop work. For example, an ongoing research activity within the C-CSE group involves the routine use of a highly hazardous chemical, TiH_2. During preparation of this IWD, the IWD was not reviewed by industrial hygiene until after a quality concern was raised by Quality Assurance. C-Division machine shops in TA-46 and TA-48 have not had exposure assessments conducted by industrial hygiene or reviews of machine guarding conducted by industrial safety, and some potential deficiencies were noted by the Independent Oversight team. In some cases, the lack of consistent, institutional ES&H programs or involvement of ES&H SMEs has contributed to inadequate hazards analyses for C-Division research activities and to the development of hazard controls that may be inadequate. For example, in the absence of consistent institutional guidance on the use of hydrogen fluoride, C-Division, upon consultation with industrial hygiene and medical SMEs, developed hydrogen fluoride training programs and supplied C-Division laboratories with calcium gluconate, a treatment often used for hydrogen fluoride acid burns. However, the distribution and use of calcium gluconate is no longer coordinated through Health, Safety and Radiation Protection Division (HSR)-2. In another example, several IWDs, which were not reviewed by ES&H SMEs, incorrectly identified medical surveillance requirements as "voluntary," which is inconsistent with practices established by HSR-2. Further, some of these medical practices are not well documented or communicated. In another example, a prerequisite for work resumption following the MSA chemical control forms (i.e., Form 1600) were submitted by the C-Division groups to LANL HSR-5 (Industrial Hygiene). However, few C-Division Groups (e.g., C-SIC) have had any feedback from HSR concerning additional controls or concerns with Category 1 chemicals or carcinogens based on their input to Form 1600. Similar concerns about the lack of sufficient SME involvement in hazards assessments and safety reviews were also identified during the 2002 Independent Oversight inspection. The 2002 Independent Oversight inspection reported that "safety and health SMEs are not appropriately involved in the planning of programmatic work" and "exposure assessments for chemical and physical hazards are not being performed as required by DOE Order 440.1A." As indicated above, industrial hygiene, industrial safety, and medical resources are insufficiently involved in some research activities. With respect to the MSA, WBS item 3.03 required as a pre-start finding that "prior to resumption, train all managers and workers in proper engagement of SMEs (including IHs and RCTs), supervisors and the Facility Management Point of Contact in IWD preparation." This pre-start finding has not been effectively implemented. (See Finding #3.)

Summary. Hazards for many research and shop work performed within C-Division have been identified, analyzed, and well documented in IWDs and HCPs. In general, researchers and staff are knowledgeable of the hazards associated with their activities and are diligent in mitigating, controlling, or removing workplace hazards. However, three areas of concern identified by the team with respect to hazard analysis are significant, particularly considering that during the past two years C-Division has had two accidents that warranted investigations by LANL investigation teams: (1) research and shop activity-level hazards that have not been sufficiently analyzed and/or documented in IWDs; (2) area or laboratory hazards that have not been identified, communicated, or adequately managed; and (3) insufficient ES&H involvement in the identification and analysis of hazards and development of hazard controls. The longstanding concern with respect to insufficient ES&H involvement in hazard identification was also identified during the 2002 Independent Oversight assessment and was a pre-start finding in the C-Division MSA. The recent report on the Type B investigation of the acid vapor inhalation accident on June 7, 2005, in TA-48 (one of the C-Division TAs also reviewed during this inspection) identified nine judgments of need (JONs) assigned to LANL. Of these nine JONs, four (i.e., JONs 1, 2, 3, and 5) were associated with the identification, analysis, categorization, and documentation of hazards. These observations indicate that immediate management focus, attention, and effort are needed in this area.

Core Function #3: Identify and Implement Controls

In general, the IWM process has been effective in identifying and documenting hazard controls through IWDs, HCPs, and SOPs that have linked the hazard control(s) to the hazard. For example, the IWD prepared for standards preparation in TA-48 RC-1 room 312 does an adequate job of defining work steps and associated controls. Work scope, hazards, and controls for laser-induced breakdown spectroscopy in TA-46, Building 41, 112 are well documented within the IWD. At TA-48, the IWD for solvent dispensing in the Kingdom area details work steps, hazards, and controls.

Engineering controls in most C-Division research labs and shops are effective in controlling hazards, are well maintained, and are being used as designed. In general, laboratory fume hoods and local ventilation systems have been calibrated as required, and these calibrations are routinely audited. In some cases, fume hood ventilation controls were state-of-the-art (i.e., computer-controlled flow rates and alarms). Doors for most C-Division laboratories have cipher locks that are programmed to permit entry only to authorized workers. The use of machine shop equipment in TA-46 is controlled through locked doors to the shop, locked equipment, and the continuous presence of a Person-In-Charge (PIC) within the shop. Almost all chemical storage cabinets are ventilated to outside the lab spaces. In many cases, gloveboxes with inert atmospheres are used for handling more-toxic chemicals. Radioactive laboratories have been specifically designed for radioactive materials in use (i.e., actinide and alpha laboratory hoods, counting facilities, and radioactive materials boundary control stations). Within Building RC-1, room 346, a C-SIC group solvent purification system has been designed and installed to enable synthetic chemists to dispense, purify, and transport solvents into inert gloveboxes with a minimum of handling and pouring.

Hazard communication postings on C-Division laboratory doors adequately reflect the bounding type of hazards for research experiments. In most cases, hazard communication placards were found to be current and to identify the applicable hazards. In some

A Glovebox Line

cases, lists of authorized workers were also posted on the laboratory doors. Within C-PCS, the MSA peer-review process resulted in a number of innovative ideas for communicating laboratory hazards through door postings (e.g., “commandments” of laser safety and laser user status boards). As a good practice, researchers in C-SIC who work with low concentrations (i.e., well below regulatory standards) of beryllium label the hoods and equipment with potential beryllium warnings.

Although in many cases hazard controls are well designed and effectively implemented, the Independent Oversight team also identified several concerns with respect to administrative controls that have not been effectively implemented, as described in the following paragraphs.

C-Division has not fully implemented the LANL work management process as defined in IMP-300.2. Research activities are addressed in a wide variety of IWDs, which are generally compliant with Notice 0142 (April 2004). When work resumed after the sitewide stand-down, Notice 0142 was the approved IWM system. Prior to work resumption, existing IWDs were reviewed for content and compliance with Notice 0142. C-Division group leaders indicate that the current Notice 0142 IWDs meet the core functions of ISM, and therefore meet the intent of IMP-300.2. However, only a few C-Division IWDs meet all the requirements of IMP-300.2, and many are non-compliant in the following respects:

- The format and content of the C-Division Notice 0142 work packages are inconsistent with the format and content of IMP-300.2-generated work packages.

- Most C-Division IWDs do not include a post-job review (IMP-300.2, Part 4), since this was not an element of Notice 0142.

- In most cases, C-Division IWDs have not incorporated the facility/work area hazards as required by Part 2 of IMP-300.2. Although Notice 0142 requires the responsible division leaders (RDLs) to assess appropriate hazards, the lack of ownership and communication of area hazards for co-located work groups is a continuing concern.

- In a number of examples, IWDs do not have signatures from both the responsible line manager (RLM) and RDL as required by IMP-300.2. For example, the IWD for TiH_2 sieving contains only two signatures – the PIC and the Deputy Group Leader, who also signs for the RDL. The PIC is also the only signature for the SMEs.

- The job hazards analysis (JHA) tool has not been used for a number of IWDs, even as a hazard validation tool for IWDs.

WBS Item 2.2 of the C-Division MSA Plan was to develop and execute an implementation plan/process for IMP-300.2 This implementation plan has yet to be formulated, and the corrective action remains open. In January and May 2005, C-Division Operations, with concurrence of the Associate Director for Strategic Research, issued memos to C-Division line managers providing guidance on work management processes until a C-Division implementation plan could be developed for IMP-300. This guidance stressed the use of another organization’s process and process hazards screening (PHS) tool in lieu of the JHA tool as suggested in IMP-300.2. A number of C-Division group leaders and staff also believe that certain elements of IMP-300.2 would not improve the work control system, or worker safety, if implemented as written, e.g., using the JHA tool to generate IWD packages. (See Finding #2.)

The IWD process has not been sufficient to identify the required qualification and mentoring processes for post-doctoral and visiting research staff prior to operating certain types of hazardous equipment (e.g., Class 4 lasers). On-the-job training (OJT) and/or mentoring is often required by the PICs for anyone operating this equipment, but the OJT or mentoring requirements are seldom structured or documented. According to several PICs, although researchers may have signed IWDs and completed the required institutional training, they may not be qualified to perform all activities identified in an IWD. For example, some workers who have signed on the Machine Shop IWD in TA-48, RC-1 are not authorized to operate all equipment listed in the IWD, and there is no structured process to qualify and authorize users on this equipment. Similarly, in the TA-46 machine shop, the PIC mentors each machine operator prior to machine use, but the mentoring process is not defined. Also, a number of staff members are trained and approved laser users and are listed on the IWD for the operation and maintenance of Class 3b and 4 lasers in Building 154, Room 111; however, according to the PIC for this laboratory, most laser users are qualified to only operate specific lasers within the room. "Mentoring" is identified as a hazard control on this IWD, although there is no structured, documented mentoring process intended to achieve qualification and there is no institutional program for mentoring researchers. The C-Division MSA (WBS item 5.3) states that "C Division will develop OJT and mentoring procedures." LANL corrective action for this MSA item indicates that the corrective action was closed as of October 31, 2004, based on developing procedures for mentoring of "students." An additional corrective action has been initiated to address OJT and the mentoring process for researchers and staff within the C-Division. The expected completion date is February 2006.

Finding #6. LANL C-Division lacks a structured process for mentoring and qualifying researchers and shop staff to operate high-hazard equipment before performing work.

In some cases, IWDs have not been adequately revised to reflect recent changes in hazards or controls prior to performing work. For example, the IWD in use for the packaging and transfer of radioactive material from the TA-48 RC-1 hot cell required a field revision after the Independent Oversight team identified a discrepancy between the equipment specified in the procedure and the IWD. The IWD and procedure developed for this transfer was not revised before the task even though new and different transfer containers had been substituted for the original containers. Once the PIC determined that no additional hazards had been introduced, a pen and ink change was made to the IWD and the work proceeded. In another example, the Independent Oversight team observed work being performed in RC-1 using medical radioisotope development procedures (MRDPs) that were referenced by the IWD that was in use at the time but did not meet the Department of Transportation package configuration requirements specified in the MRDP or the IWD. A recent Occurrence Reporting and Processing System (ORPS) report (March 2005) identified an incident in the RC-1 hot cell facility in which an off-scale reading was observed on a hand-held radiation instrument. One of the causes identified in the ORPS report was a defective procedure, similar to the MRDP procedure observed by the Independent Oversight team. Corrective actions included changes to the IWD related to this task, additional training, additional reviews of practices and procedures, and revision of the MRDPs. However, this final corrective action is not due until October 2006, and the defective procedures continue to be used and referenced in IWDs in use at RC-1. Similar concerns about performing work outside an approved IWD were identified as causal factors in the recent Type B investigation of the acid vapor inhalation accident on June 7, 2005, in TA-48. (See Finding #2.)

Radiological surveys of laboratory samples and other materials conducted by TA-48 RC-1 researchers when transferring these items from radiologically controlled areas to buffer or uncontrolled areas within RC-1 are not sufficient to detect and limit the potential spread of low level radiological contamination. RC-1 researchers are permitted to conduct qualitative surveys of materials being transferred from lab hoods and radiologically controlled areas to uncontrolled areas within RC-1. These qualitative surveys primarily use surface area wipes (Kim wipes or paper towels) and field radiation survey instruments, such as hand-held Geiger-Mueller and alpha air proportional counters. However, these instruments are not as sensitive as systems for counting surface smears. In addition, these instruments (especially the alpha air proportional counter) are not sufficiently sensitive to detect release limits (especially for transuranics) and detect potential migration of materials contaminated with low-level activity out of controlled areas.

In some cases, institutional LIRs and LIGs have not remained current with changes in requirements, laboratory practices, or integration of lessons learned from accidents and near misses. For example, the laser LIR and LIG (May 2004 and May 1999, respectively) have not been revised to incorporate the lessons learned from the LANL laser incident (June 2004). C-Division identified a similar concern during the MSA. WBS 3.04 –F6 states, "The Laser LIR and LIG are inadequate, confusing, and in some cases are in conflict with ANSI Z136.1." The C-Division interim corrective action was to issue a C-Division laser policy, which is currently in use. However, deficiencies in the institutional LIRs and LIGs remain. In another example, an HSR-5 industrial hygiene sample database, which is referenced in the Chemical Management LIR and links industrial hygiene sample data, medical surveillance information, and location/tracking of chemicals, is currently months behind schedule.

The lack of integrated institutional and C-Division training programs has required individual C-Division groups to develop separate training qualifications tracking systems. Within C-Division there is a wide variation in the separate training qualification and tracking programs developed by each C-Division group, and some groups have been more successful than others. With the diverse number of IWDs within a group, for which the PICs periodically change the training requirements, some C-Division group leaders have been challenged to keep their staff members' training requirements current. In a few cases, the required training (i.e., those specified in training plans or IWDs) had not been completed or was not current. In some cases, training requirements in IWDs (which are specified by the PICs) have not been incorporated into individual training plans at the group level and thus are not being tracked by line management (i.e., the group leader). In other cases, training requirements in HCPs and SOPs have not been included in IWDs. For example, the TiH_2 sieving IWD (C-CSE) does not include the mentoring and OJT training identified in the SOP for this activity. One of the conclusions from the recent acid-fume Type B accident in C-Division was that the IWD preparer had not received hazards analysis training, which had not been identified in the preparer's training plan. As a result, hazards analysis training for an IWD preparer has been added to all C-SIC training plans, but has not been added to the training plans for IWD preparers in other C-Division groups (e.g., C-CSE). In addition, some groups have developed training for their own staff when institutional courses do not exist, but the application of this training across C-Division groups is not consistent. For example, C-SIC has developed an HCP to address the uses, hazards, and controls associated with hydrofluoric acid (HF), but similar instruction does not appear in the training for other C-Division groups that may occasionally use HF. An assessment of non-nuclear facility training (including C-Division) conducted by the LANL Audits and Assessment Group in March 2004 found that managers had not ensured that their workers received all required training, training documentation was incomplete, and not all trainers were qualified. Some of the issues identified by the Audits and Assessment Group were associated with implementation of training at the division level, but a number of the concerns were associated with institutional training courses and training programs. The C-Division MSA WBS 8.2 states, "C-Division will develop an integrated Training/Work Authorization System for the Division." However, this corrective action is not scheduled for completion until August 2007 and no interim corrective actions have been identified.

Finding #7. Training programs applicable to LANL C-Division, at both the institutional and division levels, are not adequately structured and integrated to ensure that training requirements and controls important to worker safety are identified and verified before work is performed.

In some research laboratories that are occupied by more than one research group, there is no single point of contact to ensure that co-located hazards and concerns are identified and communicated to all occupants. For example, the "high-bay" lab (Room 115) in Building 31 has experiments being performed by two Chemistry groups (C-ADI and C-PCS) and one group from DX. Although there is a PIC responsible for each experiment, no individual is responsible for ensuring that all occupants are aware of all hazards, or to coordinate common activities (e.g., maintenance). In another example, in TA-48, two researchers within the same group and occupying connecting labs were unaware of the hazards associated with each other's experiments. This concern was also identified in the C-Division MSA and was to be resolved by the creation of a new position, namely the SPOC. During the past year the SPOC position, which was never fully implemented, was rescinded by C-Division management. A few C-Division groups have continued to maintain this position, but the issue of not adequately identifying, controlling, and communicating co-located hazards remains, as evidenced in the recent Independent Oversight work observations. (See Finding #5.)

Summary. For most activities, C-Division has identified, defined, and implemented activity-level hazard controls though the evolving IWD process. Overall, IWDs are well-written, task-structured hazard control documents that link controls to the tasks and hazards they are intended to mitigate. Engineering controls and hazard communication postings are effective. However, within C-Division, several areas require improvement, particularly regarding implementation of IMP-300.2;

increased involvement of SMEs in work planning and development of hazard controls; establishing a structured OJT and mentoring process for researchers and shop workers; and improved radiological surveys. C-Division's implementation of work control processes is hindered by outdated LIRs and LIGs and by weaknesses in the institutional training program.

Core Function #4: Perform Work Within Controls

Overall, C-Division research and development work activities observed by the Independent Oversight team were conducted safely and within the controls specific in IWDs. For example, an appropriate response to loss of ventilation (both room and hood) in several TA-48 RC-1 laboratories was observed. Following loss of a ventilation train at TA-48 RC-1, the affected laboratories were placed in a safe condition, workers vacated the spaces, and the rooms were posted to prohibit access until ventilation could be re-established and confirmed. In another example, the radiological controls for TA-48, RC-1 chemistry lab maintenance work and hot cell medical radioisotope handling and packaging were appropriately applied at the activity level. Workers followed the requirements of the assigned radiation work permit (RWP), including proper use of PPE and good contamination controls during numerous donnings and doffings of PPE. Radiological control technician (RCT) job coverage was continuous, as required by the respective RWPs, and sufficient radiological monitoring was maintained for the worker, tools, and generated waste.

In a few cases, however, some controls were not followed. In one case, electrical contractors conducting fire alarm system upgrade work at TA-48 RC-1 used high noise generating equipment (power tools, such as hammer drills and core drill) without appropriate hearing protection or warning of potential noise exposures to workers or co-located researchers. The IWD for the electrical system upgrade work requires hearing protection for work with power tools that can generate noise levels greater than 85 dBA. Workers and their supervision were not aware of what equipment met this criterion, and they were not familiar with the requirements in the IWD. Co-located workers, primarily C-Division staff (as well as transient KSL workers in the area), were not warned of the potential for high noise (in plans of the day or other verbal means), nor was any posting of high noise areas provided during this task. In another example, some controls in the IWD for standards preparation (TA-48 RC-1, C-INC division) were not followed; for example, spill trays listed as control measures were not used. In another example, radiological boundary controls (stanchions, rope, and radiation postings) around a radioactive material storage area (containing waste containers and contaminated equipment) outside of TA-48 RC-1 were adjacent to an area where workers were staging in preparation for a maintenance activity. The local RCT was notified by the Independent Oversight Team and promptly re-established the boundary controls, including the placement of additional boundary control rope.

Summary. Work observed by the Independent Oversight team was performed safely and within the controls specified by IWDs, procedures, and area postings. However, in a few isolated cases, worker protection was not fully identified and implemented, potentially resulting in unsafe conditions for the workers performing these tasks or for others in nearby workspaces.

C.2.2 DX Division Core Functions #1 – #4

The DX Division's principal activities are research, development, and testing to solve national security problems by applying expertise in high explosives, shock physics, and experimental science in support of nuclear weapons and Department of Defense programs. In addition to its experimental programs, the division is responsible for the production of high-power detonators for any new weapons systems, life extension programs, and supporting the nuclear weapons stockpile stewardship program. The DX Division is also involved in environmental monitoring and remediation research, development of advanced diagnostic techniques, industrial collaboration, and technology transfer.

The Independent Oversight team reviewed selected DX Division chemistry laboratory conditions, operations, analyses, waste management, and documentation; high explosive charge handling and preparation; routine firing site command and control, shot pre-brief, preparations, walk-down, Fire Marshal authorization, access control, clearance, execution, post-shot inspection, all-clear declaration, and associated checklists and documentation; DARHT access training, maintenance activities, and crane operations; shock physics experiments and interface activities within TA-55, an NMT Division facility; and carpenter and machine shop safety equipment, conditions, activities, hazard controls, and waste management.

Status of Corrective Actions

Although not specifically inspected by Independent Oversight in 2002, at that time DX used the LANL safe work practices process, which Independent Oversight determined to have a number of deficiencies. The DX MSA resulted in over 600 individual findings. DX addressed the pre-start findings before resuming operations and then combined the remaining findings into eight LCAPs.

Since late 2004, DX has implemented the IWM process, which represents an improvement over the LANL safe work practices process that was in place in 2002. The current status of ISM in DX indicates that initial activities to address the LCAPs have been effective in improving many of the conditions that contributed to earlier findings and that DX has made significant progress in accordance with the LCAP schedules. For example, problems identified in the MSA related to an ineffective work scheduling system have been appropriately addressed by the LCAPs, and the improved coordination of programmatic activities and resources discussed under Core Function #1 is evidence of better performance in this area. Many local corrective actions remain to be completed, consistent with the LCAP schedules. Continued DX progress to address these corrective actions, if implemented as described, should continue to improve ISM performance.

Core Function #1: Define Scope of Work

The activity-level documentation of the scope of work in the DX Division is generally sufficiently detailed to enable hazards to be adequately identified and analyzed, to develop and implement controls, and to perform the work. These documents include shot requests, procedures, IWD scopes of work, and customer requests, such as requests for waste treatment or narrative requests from external customers. Schedules for work activities are also adequately addressed. The revised "plan of the week" process, a result of MSA findings and subsequent corrective actions, ensures that programmatic activity schedules and resource constraints are addressed and better coordinated with maintenance activities.

Although most scopes of work are well defined, not all requests for work are adequately documented. In one case, DX only required verbal communication of details for a spike penetration test from an external customer, requiring the lead experimenter to develop and negotiate the definition of work scope necessary to support the shot. In another case, the information in the IWD scope of work was broader than intended or allowed by the facility safety envelope. Specifically, the IWD for DX routine firing operations at the Resource Conservation and Recovery Act (RCRA) waste treatment firing site states that the scope covers liquid disposal, but does not specify limits on the quantities of liquid wastes that could be disposed of. DX has not performed an adequate hazard analysis for disposal of large quantities of hazardous liquid waste. In practice, however, DX does not perform disposal of liquid wastes except in extremely small quantities.

Summary. Existing work documents defining the scope of DX work are generally adequate to support the analysis of hazards, the development and implementation of controls, and the performance of work for most current DX activities. Further, work schedules are adequately defined through an enhanced "plan of the week" process.

Core Function #2: Analyze Hazards

The hazards associated with explosives are well analyzed and understood within DX. Because of the potentially high consequences of explosive hazards, DX has had robust hazard analysis processes for many years. For other hazards, the IWM process within DX was performed effectively and generally results in appropriate hazard identification and analysis. Other than the isolated exceptions described below, IWDs reviewed by Independent Oversight for activities such as chemical operations, charge handling and preparation, and routine firing operations adequately identified the applicable hazards and associated risks. For example, the analysis of hazards for "Failure Cone Tests" addressed in the IWD for "Firing Operations in the Vessel at TA-40-8 (Chamber 8)" and the referenced documents were comprehensive and appropriately addressed the associated hazards.

Following the worker injury on of May 27, 2005, in a DX synthesis laboratory involving a deflagration caused by the synthesis of an unexpected energetic intermediate material, DX took effective corrective actions to better address the hazards associated with potential or unexpected energetic intermediate reactions. DX revised their IWM addressing work with energetic material to include specific steps that address a formal, documented peer review of each proposed synthesis to consider intermediate compounds and potential contaminants in addition to the previously considered analysis of the sensitivity of the products and side products. This more formal and comprehensive review by one or more scientists not directly involved with the experiment provides a better focus on all potential hazardous energetic materials and reactions and allows effective controls to be implemented.

Although most DX hazards analyses are effective, Independent Oversight observed deficiencies in the areas of environmental hazards and industrial hygiene baseline hazard surveys, as described below.

DX has not adequately addressed environmental hazards at the RCRA waste treatment firing site. The applicable IWD does not list environmental hazards or controls for waste management and environmental activities. DX relied on qualified worker training as the only environmental control specified for RCRA treatment shots; however, the qualified worker training did not meet the requirements of IMP-300.2, and other waste management activities and environmental concerns associated with shot assembly, post-shot cleanup, berm maintenance, and excavation hazards were not addressed. (See Finding #2.)

In several cases, initial or baseline surveys to identify and evaluate potential worker health risks have not been performed as required by DOE Order 440.1A. In one DX chemistry laboratory, a nuclear magnetic resonance machine is routinely used. Although the LIR addressing magnetic fields requires surveys to be performed, the current industrial hygienist could not locate any surveys for this particular machine. In a DX carpentry and machine shop, several solvents, such as acetone and ethanol, are routinely used; however, baseline exposure surveys on these chemicals have not been performed. These qualitative controls are not based on a quantitative evaluation of the associated hazards and do not meet the requirements of DOE Order 440.1A for industrial hygiene baseline surveys. (See Finding #3.)

Summary. The IWM process adequately addresses identification and analysis of hazards, and in most cases, DX appropriately implements the requirements. Although most DX hazards analyses reviewed by Independent Oversight were appropriate, DX has not effectively addressed environmental and waste management hazards in IWDs and has not ensured that adequate industrial hygiene baseline hazard surveys are performed for all workplace hazards, as required by DOE Order 440.1A.

Core Function #3: Identify and Implement Controls

In general, DX develops and implements appropriate controls for the identified hazards. When possible, engineered controls are introduced to minimize hazards or consequences. For example, the use of foam to encompass beryllium contamination at DARHT and the use of containment vessels at several firing points have reduced environmental releases. In a DX carpentry shop, the machines were found to have proper guarding and shielding. When engineered controls are not practical, appropriate administrative controls are commonly used. For example, chemistry and shot procedures are generally technically accurate and complete, are well written, and contain the appropriate information and level of detail. DX also has an extensive access control program for its firing sites to ensure that all personnel are accounted for and in a safe location prior to shots. In another example, deployment of waste management coordinators into the DX organization has resulted in better control of waste management activities. In a DX carpentry and machine shop, use of a formal training and qualification process, postings, and administrative controls on flammable substances (magnesium metal cuttings) and on loose fitting clothing effectively contribute to a safe work environment. Finally, DX appropriately applies PPE when engineering and administrative controls are insufficient. For example, the IWD for DX chemistry operations lists all the common solvents used in the laboratory and provides a primary and alternate choice of glove types for each solvent.

The DARHT access training is noteworthy. It is a comprehensive, informative, professionally developed, slide-based presentation with a soundtrack that presents the facility hazards and associated controls in an interesting manner. The presentation provides pertinent information to visitors and workers and includes directions and maps to DARHT, a pictorial tour of the facility with excellent narrative, concise descriptions of safety systems, personnel responsibilities, and descriptions of routine operations. Using a slide presentation instead of a video makes it easy and economical to update the presentation when requirements change or to reflect lessons learned.

Interfaces between DX and other LANL organizations are generally well-defined. The roles and responsibilities for DX activities at TA-55 are documented in a tenant agreement between DX and

NMT that specifically addresses such areas as approved operations and responsibilities for safety, security, training, and work authorization. Although the document has not been revised to specifically address the IMP-300.2 IWM process, the responsibilities are written to clearly show that DX must follow all NMT-specific work authorization and safety documents, which include IWDs. Interfaces at DX facilities are similarly well-defined. For example, any workers coming into DARHT must provide appropriate IWDs for work to be performed and obtain facility-specific input for the IWDs. To further clarify IWDs at the DARHT firing point, the facility provides a central location for IWDs and organizes and color-codes IWDs based on whether they are DX or outside organization IWDs and whether they are shot-specific or non-shot related. As a result, interfaces between organizations are enhanced by providing everyone easy access to active IWDs.

IMP-300.2 requires that line managers authorize workers to perform work only after verifying that the workers have completed the required training and are currently qualified. However, DX uses a division-level database for this function that is neither comprehensive nor current. As a result, for instance, the training database did not show that one firing site technician had completed all the required training and reading to be qualified to work independently at a firing site; as a result, the technician's supervisor had to complete a "DX Division Authorization and Worker Assignment" document attesting to the fact that the individual was appropriately qualified and assigned, before the work could proceed. This problem also delayed a number of staff from being designated as qualified or re-qualified as firing site leaders. LANL is implementing a new interactive training database that could provide the required information, but there have been delays in implementation and DX has not yet populated the system with a comprehensive list of training requirements for DX staff positions. (See Finding #2.)

In addition to training weaknesses, deficiencies in DX division IWD preparation indicate that institutional guidance, instructions, and training for IMP-300.2 have been ineffective in some areas. In several cases, workers prepared and managers approved IWDs erroneously marked as "standing" IWDs. In some of these cases, the IWDs were marked as being qualified-worker IWDs, even though DX has no qualified-worker tasks identified and analyzed that meet the IMP 300.2 requirements. In another example, DX used the IMP-300.2 hazard grading matrix as a risk assessment in several recent IWDs, including performing additional risk analysis activities and obtaining input from the National Nuclear Security Administration Service Center on risk assessment as part of the hazard grading. However, the grading matrix is only intended as a hazard identification tool for determining the level of analysis. As a result, DX personnel prepared and managers approved some IWDs with hazard grading results that were not in accordance with IMP-300.2 requirements. For example, preparers checked blocks indicating that activities met the criteria for high-hazard activities but, contrary to the IMP-300.2 instructions, marked the activity hazard as moderate because of risk analysis results. Additionally, with the exception using the qualified-worker exemption for environmental and waste management activities described under Core Function #2, the mistakes in IWD preparation had minimal apparent effect on the effectiveness of the hazards analyses and identified controls in the IWDs, but did illustrate insufficient understanding of the specifics of the IWD process by DX personnel. (See Findings #1 and #2.)

In other cases, a few specific IWD controls within otherwise acceptable IWDs were inadequate to completely control the identified hazards:

- Waste management and environmental controls have not been adequately integrated into some IWDs. For example, IWDs for charge handling operations and chemical synthesis of energetic materials do not provide controls for such waste management activities as disposal of solvent wipes or storage of wastes. In another example, the IWD for open detonation at the RCRA treatment, storage, and disposal firing site (Minie) does not include specific environmental controls, but instead lists reference documents that provide controls for all DX firing sites. Because the specific controls for meeting the treatment, storage, and disposal requirements are not identified in the IWD, there is insufficient assurance that only the controls that are needed to meet permit requirements are selected from among the numerous controls, which vary depending on the firing site and are contained in several different SOPs.

- In two separate cases, a high-explosive handler placed tape over the bolt holes in the top of a cylinder to prevent inadvertent introduction of high explosives into the threads and cavity of the cylinder's bolt holes during high-explosive filling operations and during removal of the spike from the post-penetration shot assembly. The tape was intended to mitigate the potential for pinching, compressing, or causing friction of high explosives when bolts were installed. While the associated IWDs listed these as hazards and the handler's actions were appropriate for the hazards, the IWDs did not associate those hazards with the filling operation, did not address the bolt holes, and did not list the control that the handler used (also see the discussion under Core Function #4).

- In an attachment to a standing IWD for routine firing operations, which addresses unique aspects of a planned shot, the description of the activity states that "the controls listed below either supplement existing controls or supersede them when there is a conflict," but does not list which controls are supplemented or superseded. This approach does not meet the criteria of being "worker friendly," with a focus on information that the worker needs. In the same IWD attachment, a key-lock control identified in the procedure to ensure that a hydraulic system did not initiate prematurely was not listed as a control in the IWD.

- A DX carpentry and machine shop IWD does not provide sufficient controls to ensure that noise and chemical exposure limits are not exceeded. Although loud equipment is routinely operated, the IWD only implements a qualitative control on hearing protection (i.e., if the machine noises required shouting, then ear plugs should be used). The same IWD also implements a qualitative control on chemical exposure (only small quantities will be used, or if large quantities are used an industrial hygienist will be consulted). In both cases, specific values are not provided as required by IMP-300.2.

- NMT procedures used by DX personnel in TA-55 for 40mm target preparation and shot alignments specify alcohol (ethanol) as a solvent, and DX and NMT-16 personnel use a 0.5 liter squirt bottle of ethanol inside the glovebox for cleaning. Neither the IWD nor the HCP addresses use of ethanol in the glovebox from a facility hazard perspective, and therefore neither document provides any controls on the quantity of ethanol in the glovebox. None of the workers or supervisors knew of any facility limits on combustible liquids in gloveboxes. The TA-55 fire hazards analysis limits solvents in gloveboxes to "small quantities." However, this limit is not translated to a useable control for workers introducing solvents to the gloveboxes. (See Appendix E for further discussion.)

Summary. In most of the activities reviewed by Independent Oversight, appropriate controls had been established and implemented for recognized hazards. Although DX implementation of controls is generally positive, many workers are not aware of the benefits of the IWM, worker training and qualification is not adequately tracked, and in a few cases, IWD controls are not sufficiently tailored to completely address the hazards.

Core Function #4: Perform Work Within Controls

Readiness to perform work and work authorization in DX is verified by numerous methods, including schedules, access control protocols, IWD approvals, daily Fire Marshal authorization, requests for waste treatment approvals, pre-job briefings, and PIC release of work. Observed pre-job briefings effectively covered the identified hazards and controls.

The DX operations that were observed were generally performed safely and in accordance with established controls. Workers performed operations in accordance with the hazard controls identified in appropriate procedures and IWDs. Workers who were interviewed indicated that they felt empowered to stop work if safety concerns arose. Satellite accumulation areas are operated in accordance with requirements. Shots are performed in accordance with established checklists, and laboratory activities are performed in accordance with established PPE requirements and procedures.

Although most observed work was performed safely, workers did not follow established controls in three isolated cases. In one case, laboratory personnel did not label a container containing a peroxide hazard in accordance with DX requirements. In two separate cases involving related IWDs used during spike penetration tests (one involving shot preparation and a second involving routine firing operations), a worker identified a previously recognized but unmitigated hazard and implemented undocumented controls (in both cases installing tape over bolt holes) without revising the associated standing IWDs or otherwise implementing the IWM process. (This was further discussed under Core Function #3, above.)

Summary. Most observed DX work was appropriately verified ready, authorized, and performed within established controls. Although Independent Oversight observed a few isolated deficiencies, DX personnel generally were effective in performing work within controls.

C.2.3 TA-55 Programmatic Work Core Functions #1 – #4

The NMT Division operates the TA-55 plutonium facility. NMT is a multidisciplinary organization responsible for the science, engineering, and technology of plutonium and other actinides in support of the nation's nuclear weapons stockpile, nuclear materials disposition, and nuclear energy programs. The division conducts and provides support for scientific research and development on strategic nuclear materials in TA-55 and other nuclear facilities that it maintains and operates. The TA-55 facility supports pit manufacturing, surveillance, and special plutonium recovery. TA-55 also provides chemical and metallurgical processes for recovering, purifying, and converting plutonium and other actinides into many compounds and forms. Additional capabilities include the means to safely and securely ship, receive, handle, and store nuclear materials and to manage the wastes and residues produced by TA-55 operations.

Independent Oversight's review of core function implementation at TA-55 examined a sample of programmatic work activities conducted by several NMT Division groups, including NMT-2, NMT-5, NMT-9, NMT-11, and NMT-16. Operations reviewed included glovebox handling and manipulation of actinide materials in support of specific research, development, and manufacturing needs, and certain programmatic maintenance activities such as high efficiency particulate air (HEPA) filter and glove changes, bagouts, and decontamination/waste packaging activities. A key focus of the review was to evaluate NMT's implementation of sitewide ISM requirements, including the IMP-300.2 process.

Status of Corrective Actions

TA-55 was not specifically inspected by Independent Oversight in 2002. However, NMT programmatic activities in CMR were reviewed in 2002, and some deficiencies similar to those discussed in this inspection were identified. For example, some hazards and associated controls were not identified or analyzed because line management lacked sufficient tools and guidance, such as involvement of safety and health SMEs in planning programmatic work. Safety and health requirements in LIRs were not adequately incorporated into HCPs, and work instructions and hazard controls were not always sufficient because of weaknesses in HCPs, work instructions, specification of PPE, and related areas. The NMT Division MSAs identified a large number of individual findings in a broad range of areas, a number of which pertained to work planning deficiencies and inconsistent application across NMT groups. The large number of individual findings were grouped by relevance and similarity and combined into several LCAPs.

NMT Division management expends significant effort in addressing findings and corrective actions, including participation in weekly progress and status meetings to review LCAP issues, status of actions, milestones, and schedules. However, many local MSA corrective actions remain to be completed, and some corrective actions have not been effective in correcting past findings. In one example identified during this inspection, a local corrective action pertaining to an MSA finding on radiological work control documents was closed but did not include extent-of-condition reviews and review or correction of any deficient HCPs and work instructions. Consequently, these documents still lack required work control information as identified by the MSA finding. Also, although corrective actions to address 2002 findings resulted in changes to work control processes, a variety of similar concerns were noted during this inspection. Additional efforts are needed by the division to evaluate root causes and approaches to developing corrective actions that address symptoms and prevent recurrence.

Core Function #1: Define Scope of Work

The scope of work for most programmatic activities at TA-55 is described in facility safety and operations documentation. At the facility level, program activities are generally described in the facility's currently approved safety analysis report. (See Appendix E.) Specific operations within laboratories or workstations are further described within group-level documents, such as HCPs, IWDs, and work instructions. These documents generally define the scope of work in significant detail, and are sufficient to permit effective identification and analysis of hazards. Hundreds of these work control documents have been developed by the individual NMT organizations. To manage the large number of documents, NMT effectively uses a comprehensive document management system called Documentum. Each NMT group maintains a series of

Documentum folders where current versions of approved work control documents reside. The folders are arranged by group and include separate sections for HCPs, IWDs, work instructions, and related material, greatly facilitating access to and retrieval of key documents.

While the work scope for most research and manufacturing operations is well defined, some programmatic support activities, such as bag-ins, bagouts, glove changes, and HEPA filter changes, occur at various locations within TA-55. For these activities, work control documents describe the general tasks to be performed but do not provide sufficient detail to ascertain the unique hazards and controls associated with the job. In these cases, additional evaluation by the worker is needed at the time of the job to evaluate some hazards and controls. For example, NMT-5 workers performing a HEPA filter change were using a generic work instruction that listed fall protection controls not applicable to the work because workers would not be accessing areas above four feet. Similarly, workers bagging out trichloroethylene (TCE) samples were using a work instruction that did not address specific chemical hazards or controls for TCE. Combination cartridges were in use based on verbal instruction from HSR, but were not required by the governing work instructions. In these examples, IWDs more specifically tailored to the actual activity to be performed (e.g., replace GB XXX HEPA filter or Bag out TCE samples in GB XXX) would have required evaluation of the specific hazards associated with the work and needed controls, consistent with the expectations of IMP-300.2.

Summary. The scope of work for most programmatic activities is well defined by HCPs, IWDs, and process work instructions. These documents define the scope of most work in significant detail, and are sufficient to permit effective identification and analysis of hazards. In a limited number of cases, scopes of work for repetitive activities that take place in different locations in TA-55 (e.g., HEPA filter changes, glove changes, bagouts) are not defined in sufficient detail to evaluate all specific job hazards. However, worker experience, training, area familiarity, and evaluation at the work site have been sufficient to ensure that the work scope and hazards are properly understood for these activities prior to the work.

Core Function #2: Analyze Hazards

NMT uses several processes to identify hazards associated with activity-level program work. Process hazards analyses and HCPs are mechanisms for identifying hazards for one or more groupings of similar manufacturing or research activities. These documents generally encompass the principal hazards that may impact the worker, the public, or the environment. At the task level, these documents are supplemented by work instructions and IWDs, which more specifically document the unique hazards a worker may encounter during each task of a specific operation. A positive attribute of the LANL IWD process, both IMP-300.2 and its predecessor Notice 142, is the requirement for linkage of hazards (and controls) to individual work steps. While there is some variation in the quality and clarity of task breakdown in the NMT IWDs that were reviewed, all identified the hazards associated with each step or task. When implemented as intended, these mechanisms provide a comprehensive listing of hazards associated with work activities.

Although hazard identification processes produce the required hazard listings, the level of rigor associated with preparation of work instructions and IWDs varies, and not all unique hazards are sufficiently defined by the IWD to allow specific controls to be identified, as required by IMP-300.2. As indicated under Core Function #1, unclear hazard definition was most evident in work activities governed by generic work instructions that do not define the specific work scope. Other examples were also noted in process operations that involve use of chemicals, most of which are not specifically called out by the IWD. For example, a number of IWDs in NMT-2 and NMT-11 simply list "chemicals" under the hazard listing without listing the specific chemicals or groups of chemicals that present similar hazards and controls. (See Finding #2.)

NMT-5 uses a rigorous process to plan some programmatic maintenance-type work. This NMT group prepares a work traveler that specifically defines the job to be performed— the only group to use this level of work planning for maintenance-type activities. For example, work order 000233 was prepared specifically for replacement of GB 335 exhaust HEPA filter. However, despite this level of work planning detail, the hazards analysis did not delineate the specific hazards or controls needed for the work. Instead, a generic Notice 142 IWD and work instruction for HEPA filter changes was attached to the traveler, which included requirements for a control (i.e., fall protection) for a hazard that did not apply to the work (i.e., no work above 4 feet was planned).

Some hazards have been identified but not properly analyzed. An NMT-11 work instruction for analytical measurements in plutonium powders references the possible creation of dilute (less than 1.2 percent) HF during filtrate generation. The work instruction further states that "*an HF concentration below 1.2% is considered safe and can be safely removed from skin by rinsing with water for 15 minutes.*" This conflicts with the MSDS for less-than-1 percent HF, which indicates an acute hazard even at low concentrations. Accidental exposure calls for a water rinse followed by 15 minutes of calcium gluconate application. It should be noted that HF may be particularly hazardous at low concentrations because symptoms of exposure may be delayed for 24 hours or more, requiring even more rigor and awareness of the potential for accidental or unexpected contact. These hazards analysis problems may be caused or compounded by the lack of required HSR SME involvement in the IWD process (see Findings #2 and #3).

Radiological hazards are prevalent throughout TA-55. However, these hazards also have not always been subjected to appropriate evaluation through work planning mechanisms and interface between line management and HSR. For example, in NMT-11, radiological hazards are identified but the unique hazards associated with use of neptunium during fuel production are not adequately called out, analyzed, or documented. Standard plutonium controls, such as plutonium bioassays, would not be adequate for neptunium but were not evaluated and/or modified for this operation. The process hazards analysis, HCPs, and work instructions for actinide fuels work do not adequately define or analyze the special hazards posed by the use of 100-gram quantities of neptunium powders by NMT-11 workers; for example, the site's standard bioassay program and TA-55 health physics questionnaire are only designed to account for plutonium, uranium, americium, and tritium. Specific controls must be put in place to ensure that appropriate neptunium bioassays are performed following workplace events involving neptunium because the standard plutonium bioassay would be ineffective in detecting or quantifying neptunium intakes. Further, the HSR-12 protocol for placing individuals on a routine bioassay program indicates that NMT-11 fuel production workers handling 100 gram quantities of neptunium may need to be on a routine neptunium bioassay program. Calculations performed by HSR-12 following Independent Oversight's inquiry indicated a threshold of nearly 1700 grams; however, the calculations were based on a release fraction of 0.001 for "solids and spotty contamination" versus a release fraction of 0.1 for "nonvolatile powders," which is more reflective of what NMT-11 handles. Using the latter release fraction, a threshold quantity of as low as 10 to 20 grams may warrant routine bioassay for neptunium in accordance with ANSI/HPS N13.29-2001, which the site uses to determine routine bioassay needs.

In addition to bioassay concerns, there are also potential inadequacies in the assessment of neptunium airborne contamination from instruments designed and calibrated for plutonium. The lack of comprehensive hazards analysis has resulted in the lack of an appropriate, documented technical basis for addressing these issues.

Finding #8. Potential radiological hazards posed by neptunium and isotopes other than plutonium, americium, uranium, and tritium are not adequately addressed by existing LANL TA-55 hazards analysis processes or HSR mechanisms.

Summary. A variety of methods are used to identify hazards associated with activity-level program work. Process hazards analyses and HCPs identify hazards inherent in one or more groupings of similar manufacturing or research activities. At the task level, these documents are supplemented by work instructions and IWDs, which more specifically document the unique hazards a worker may encounter during operations. IMP-300.2 and its predecessor Notice 142 require linkage of hazards (and controls) to individual work steps, thereby enhancing the previous LANL work control processes. In most cases, the hazards analysis mechanisms result in a comprehensive listing of hazards associated with work activities. However, lack of required SME involvement limits the effectiveness and accuracy of hazards analysis efforts. Insufficient rigor and analysis of hazards posed by chemicals and use of non-routine radioactive material at TA-55 has resulted in potentially inadequate controls.

Core Function #3: Identify and Implement Controls

NMT appropriately uses a variety of engineering and administrative controls, coupled with PPE, to mitigate hazards from many TA-55 activities. Engineering controls are used extensively, including containment and confinement devices, such as gloveboxes, hoods, and ventilation systems specific to the work. Engineered controls are complemented by a variety of administrative controls, including work permits, administrative procedures, IWDs, and work instructions prepared to control particular activities. In addition, NMT and HSR conservatively require that all personnel don a minimum level of PPE in all production areas, even though most of these areas are normally free of contamination.

LANL has defined the IMP-300.2 process as the primary mechanism for communicating hazards and controls at the task level. IMP-300.2 replaced the Notice 142 interim work control process in 2004. However, most NMT programmatic activities reviewed by Independent Oversight continue to be governed by work control documents prepared under Notice 142. This situation is authorized by NMT-AP-045, the official division-level process document that implements IMP-300.2, which took effect in May 2005. NMT-AP-045 is generally comprehensive and appears to outline a reasonable approach and graded implementation plan for achieving compliance with IMP-300.2. Division management indicates that the site IWM coordinator concurred with its content and acceptability.

While adequate in principle, Independent Oversight identified two key flaws in AP-045 that have impacted NMT's compliance with all IMP-300.2 requirements. First, the document does not address key elements of IMP-300.2 related to qualified-worker status. Specifically, there are no provisions to ensure that NMT's authorization of moderate-hazard qualified-worker activities meet all institutional requirements, including adequacy of training materials, review and approval of division qualified-worker activities by the site IWM coordinator, and placement on the IWM website. Several NMT groups, such as NMT-5, currently use the qualified-worker provision to perform significant programmatic work without IWDs, but they do not meet all IMP-300.2 requirements. For example, no NMT qualified-worker activities are currently listed on the site IWM website, as required to utilize this provision. Also, training materials used to justify qualified-worker activities in NMT do not contain all activity-level hazards and controls and therefore do not demonstrate equivalency with Part 1 of the IWD. Lastly, IMP-300.2 allows for qualified-worker status as an alternative to Part 1 of the IWD but does not indicate that Parts 2, 3 and 4 are also exempt. NMT incorrectly authorized these activities as qualified-worker activities without adequate justification and without review and approval by the site IWMC. (See Finding #2.)

In a second concern, NMT-AP-045 did not define the review process necessary to ensure that Notice 142 IWDs and work instructions that are used as NMT work control documents meet the specific requirements of IMP-300.2. While the NMT RLM has certified that these requirements are being met, there is insufficient evidence to demonstrate that systematic reviews of individual IWDs have been performed against IMP-300.2 requirements to certify compliance. For example, there is no documented evidence of specific review criteria or of any findings associated with existing Notice 142 IWDs. Independent Oversight's review revealed a variety of deficiencies in Notice 142 work control documents that were deemed by NMT to comply with IMP-300.2, as discussed below. (See Finding #2.)

A number of Notice 142 IWDs, HCPs, and work instructions that were reviewed did not meet IMP-300.2 requirements for specificity of controls, and in many cases, IWD controls differed from and sometimes conflicted with the associated work instructions and HCPs. Such a condition does not meet IMP-300.2 requirements. For example:

- The NMT-2 IWDs and work instructions for dissolution and purification/recovery refer to the use of toxic/pathogenic chemicals and cite the MSDS for controls, in conflict with IMP-300.2. In particular, the work instruction for dissolution refers to use of HF, which normally requires special controls and emergency response procedures; however, such controls are not listed. Similarly, NMT-2 has one of the highest collective doses within NMT Division; however, external exposure controls listed in the IWD and work instructions refer to generic time, distance, and shielding and *"follow ALARA"* as controls, with no further information about specific actions that should be considered or when specific actions should be applied. The HCP for aqueous chloride operations (covering these IWDs and work instructions) references a control for "*measurement of radiation readings when dealing with suspected high-radiation items,"* but there is no indication of where this is expected to occur.

- As discussed, the NMT-11 work instruction for analytical measurements in plutonium powders referenced the possible creation of dilute (less than 1.2 percent) HF during filtrate generation. This hazard and any needed controls (including availability of calcium gluconate gel) are not listed in the IWD.

- The NMT-11 IWD, work instruction, and HCP for actinide batch processing each differ in the radiological controls needed for the same work.

For example, the work instruction requires surveys and RCT coverage while the IWD does not, and the HCP requires an RWP. None of these controls were accurate or implemented. According to some staff, the words "personal dose/exposure surveys" referenced in the work instruction might mean thermoluminescent dosimeters (TLDs)—an unconventional interpretation of the word "survey." RCT coverage is also not defined and could mean several things (no RCT was present to perform surveys during the evolution). The requirement for an RWP listed in the HCP is incorrect because the HCP work instruction is intended to serve that purpose (see discussion of radiological work control documents, below).

- For ladder and scaffolding hazards, the NMT IWD for glovebox exhaust Zone 1 HEPA filter replacement lists only the following controls: *"proper set-up of ladders, climb with three points of contact, and use equipment as intended by manufacturer."* The work instruction contains completely different controls, including a reference to 29 CFR 1910.23 for fall protection. In most cases, the controls listed in the work instruction are clearer than those in the IWD.

- The NMT-16 40 MM Impact Test Facility IWD simply refers to the HCP for hazards and controls, and the HCP uses non-specific controls such as, *"Workers shall wear appropriate PPE"* and *"Workers shall use appropriate tools in a safe manner."* Neither the IWD nor the HCP lists use of ethanol in the glovebox as a hazard, and therefore neither document provides any relevant facility safety controls, such as limitation of quantity in the glovebox. (See Appendix E.)

Examples similar to those noted above were evident in a variety of NMT Notice 142 work documents reviewed. According to NMT-AP-045, these documents were deemed compliant with IMP-300.2 and thus will remain valid until their next scheduled revision or review, which in some cases is two years. Such conditions are contrary to the expectations defined by the IMP-300.2 work control process. (See Finding #2.)

Independent Oversight also reviewed a limited number of IMP-300.2 IWDs for new activities, such as some activities in NMT-9 and NMT-15. While the sampling was small, these documents were more rigorous and better specified controls than the Notice 142 documents discussed above. At present, most NMT programmatic work does not use IWDs prepared under IMP-300.2. Thus, additional divisional focus on migration of existing work control documents to IMP-300 standards may improve the clarity and consistency of the defined hazard controls.

A separate concern was identified in the quality and content of radiological work control documents, such as HCPs. A similar issue (HCPs not addressing all radiological requirements) was identified during the 2004 NMT MSAs but has not been adequately corrected. NMT's corrective action for this finding was to issue a laboratory variance to the LIR requirement stating that only the applicable requirements from the LIR are to be included in the NMT work control documents. However, the corrective action did not include extent-of-condition reviews and review or correction of any deficient HCPs and work instructions. Consequently, these documents still lack the required radiological information for a governing radiological work control document. (See Finding #13.)

Under LIR 402-700-01.1, *Occupational Radiation Protection Requirements*, RWPs are the primary radiological work control documents. However, the LIR allows for the use of HCPs for routine radiological work if these documents include the same standard radiation protection requirements and information that would be included in an RWP. Currently, most NMT programmatic work in radiological areas is governed by an HCP rather than RWP. While TA-55 RD-555 contains specific radiological information and requirements for many general radiological work activities within PF-4, none of the NMT HCPs that were reviewed contained the required radiological information needed by the worker for the specific activities, and none of them met LIR requirements for radiological information required in an RWP. For example, HCPs and work instructions did not specify anticipated or actual radiological conditions, RCT coverage requirements, or limiting conditions, all of which are key elements of an adequate RWP or radiological work control document. In a related concern, there is insufficient HSR-1 involvement in the review and approval of HCPs, which serve as the primary radiological work control documents in lieu of an RWP. Under TA-55-RD-555, *TA-55 Radiation Protection Requirements*, HSR-1 approval is required for RWPs and procedures used to control radiological work. However, HCPs at TA-55 have not been approved by HSR-1.

Finding #9. LANL NMT radiological work control documents, such as HCPs and work instructions, do not contain all required radiological information and are not reviewed or approved by HSR-1 as needed to ensure that workers are properly informed of radiological conditions.

Independent Oversight also identified concerns about the adequacy of external radiation surveys in radiological areas and in support of programmatic work. These deficiencies are discussed in the following paragraphs.

First, radiation surveys are not always performed during programmatic work that involves changing conditions, and neither institutional nor divisional requirements clearly specify when such surveys are needed. For example, NMT-2 activities separating americium salts from plutonium have resulted in contact gamma dose rates greater than 1000 mR/hr at the glovebox window, based on informal surveys performed by some workers who borrowed an ion chamber from HSR. There has been no RCT coverage or documented surveying during this work. The actual external dose rate was likely higher than that measured by the ion chamber because of neutron contributions that were not detected by the gamma instrument.

The institutional requirement for external surveys in ESH1-06-02.2 is that routine surveys be performed *"before, during and after work that has the potential to result in significant changes in radiological conditions."* However, the term *"significant"* is not defined. TA-55 RD-555 has the same criterion except that it does not provide the *"significant changes"* caveat; this criterion is also unclear and does not meet expectations because any handling or movement of material can result in minor changes in radiological conditions that would not normally require additional worker awareness. Notwithstanding the lack of clear criteria, ESH1-06-02.2 conveys that workers must be aware of radiological conditions as part of the ALARA process.

TA-55 RD-555 and the TA-55 radiation monitoring instructions also state that *"it is critical that workers inform HSR-1 of operations that change radiological conditions, have the potential to change radiological conditions, or may necessitate changes in radiological monitoring methods or instrumentation. For example, changes in radionuclides, quantities, physical or chemical form, or process must be communicated to HSR-1 supervision or leadership. Such changes could require corresponding changes in routine surveys or air sampling and monitoring to ensure proper characterization of the radiological hazard."* Although NMT conducts formal plan-of-the-day/plan-of-the-week meetings, these meetings do not encompass or address most routine NMT programmatic operations. There is limited interface through the plan-of-the-day between division management, NMT groups, and HSR for routine programmatic work. Programmatic activities are only addressed when "hot jobs," such as glove changes, are performed, because these jobs require continuous RCT coverage. NMT's implementation of the plan of the day is not as rigorous as defined in the LANL Conduct of Operations LIR and Conduct of Operations Implementation Manual in that many programmatic activities are not addressed. This approach is based on the assumption that most programmatic operations do not impact other groups and therefore do not require review or resource loading during the plan of the day. However, the requirement to advise HSR of operations that change radiological conditions, have the potential to change radiological conditions, or may necessitate changes in radiological monitoring methods or instrumentation is not addressed through the plan of the day or an alternative mechanism.

Finally, the lack of programmatic radiation surveys during programmatic work is not mitigated by the TA-55 routine survey frequency for radiation surveys. The TA-55 HSR-1 radiation monitoring instructions only require quarterly radiation surveys of gloveboxes, regardless of the radiation levels or posting status of the area. For gloveboxes located in radiation areas (with dose rates exceeding 5 mrem/hr), this frequency is much less than the suggested weekly frequency for routinely occupied radiation areas specified in ESH1-06-01.2. There is no documented technical basis or justification for the less-conservative frequency stated in the TA-55 instructions.

Finding #10. LANL NMT line management and HSR have not ensured that sufficient radiation surveys are performed during work that involves changing radiological conditions to ensure that workers are aware of radiological conditions and can effectively minimize exposures.

A few deficiencies were also identified in radiation area postings and contamination surveys. First, some radiation area postings did not adequately define the boundaries of the area and were not in compliance with institutional requirements for signage or information that must be conveyed by the sign. Instead of the three-part signs required by LANL, these postings were small labels attached to the glovebox. Since the labels are placed on the glovebox rather than at the entrance or location where the radiation area begins, personnel could inadvertently enter a radiation area without the required warning. Most TA-55 work areas are posted as radiation buffer areas because contamination levels are expected to be below 20 dpm/100 cm^2. However, the routine survey records that were reviewed did not demonstrate sufficient quantitative contamination surveys in laboratory spaces to demonstrate compliance with surface contamination and posting requirements. In some cases, survey forms only document that large area wipes had been taken. This method can only be used for qualitative purposes because of averaging constraints and lack the sensitivity to detect down to 20 dpm/100 cm^2 of removable alpha contamination, as required for comparison with regulatory requirements.

Summary. NMT appropriately uses a variety of engineering and administrative controls, coupled with PPE, to mitigate hazards from many TA-55 activities. Engineered controls are complemented by a variety of administrative controls, including work permits, administrative procedures, IWDs, and work instructions prepared to control particular activities. LANL has defined the IMP-300.2 process as the primary mechanism for communicating hazards and controls at the task level. NMT's implementing document for IMP-300.2 does not contain sufficient detail about IMP-300.2 requirements, resulting in some work control deficiencies (e.g., inadequate specification of controls). IWDs, HCPs, and work instructions contain numerous deficiencies and inconsistencies in the specification of hazard controls. An NMT corrective action related to an MSA finding on radiological work control documents was not effective, resulting in continuing deficiencies in the presentation of required radiological information to workers. Further, efforts to control external radiological exposure are not supported by sufficient radiation surveys during programmatic work to determine the magnitude of changes in radiation levels and ensure the effectiveness of ALARA efforts.

Core Function #4: Perform Work Within Controls

Most observed PF-4 programmatic operations were performed safely and in accordance with requirements. The room controller process was used effectively to ensure readiness to perform work. Room controllers appropriately walked down assigned areas, checked the status of equipment and safety systems such as continuous air monitors, and updated the door postings with information about room status and special controls before authorizing work to commence. Technicians were highly knowledgeable about their processes and diligent in performing equipment checks, maintaining glovebox integrity through cautious work practices, and monitoring hands upon removal from gloves. (However, monitoring speeds were often too fast, as discussed below.) All personnel observed in PF-4 wore the required level of PPE, and workers performing hands-on work donned appropriate extremity dosimetry and were observed using puncture-resistant gloves when handling sharp objects. Personnel exiting process rooms followed the requirements to use exit frisking equipment that is located at all exit locations.

However, some observed PF-4 contamination control practices were not sufficient to detect the potential for spread of contamination. Although workers used hand-held friskers upon removing their hands from gloves and before exiting areas, most individuals frisked far too quickly to detect contamination at levels that would exceed radiation buffer area criteria. An RCT covering a bag-in also frisked himself and workers too quickly to adequately detect low levels of contamination. Personnel were observed handling items (including doffed respirators) and contacting surfaces in the radiation buffer area with bare hands, contrary to RD-555 requirements. These specific problems were addressed promptly by facility management and performance improvement were noted during the inspection, but sustained attention is needed.

Because of inattention to detail or lack of rigor, some work activities are not performed in accordance with requirements and/or deficiencies in work control documents are not identified before proceeding with work. For example, hazards and controls identified in the IWD for actinide ceramics batch preparation did not contain all the controls identified in the work instructions, but this anomaly was not questioned. A requirement in the work instruction for RCT coverage and personal/exposure surveys was also not followed or questioned. Hazards and controls were not reviewed during the pre-job brief for HEPA filter changeout by NMT-5 because personnel were thought to be familiar with the procedures due to their prior experience and training on the work instruction. During the evolution, a step platform was staged on top of loose, unnecessary brown paper in the area rather than on a smooth and clean floor surface (as required by the work instruction), and a worker was observed using his fist rather than a tool to drive the spacer into the filter plenum.

Summary. Most observed work was performed safely in accordance with stated requirements. Technicians and workers were skilled and knowledgeable and exercised appropriate diligence and caution when working in contaminated gloveboxes and with potentially contaminated/hazardous components, and most controls were followed. While some observed contamination control practices were not sufficient to detect the potential for spread of contamination, management actions were taken and these practices improved during the assessment. Sustained diligence in this area is needed. While there were a few examples of not following requirements, not minimizing safety risks, or not questioning work package anomalies, most work at TA-55 was performed safely and in accordance with requirements.

C.2.4 Maintenance and Construction

KSL is a support contractor to LANL that performs maintenance and construction activities. LANL Facilities Management Division (FMD) coordinates the KSL support services for the various LANL divisions. This Independent Oversight inspection focused on the safety of KSL maintenance and construction activities performed at C-Division facilities at TA-48, NMT facilities at TA-55, and various DX facilities. Work packages were reviewed, managers were interviewed, and maintenance and construction activities were observed to assess the management of safety associated with this work.

Status of Corrective Actions

The 2002 Independent Oversight assessment and subsequent self-assessments by LANL identified deficiencies in the LANL work control process and in the application of this process to KSL maintenance and construction activities. Independent Oversight reviewed corrective actions taken and planned to address problems identified during these assessments. Corrective actions included changes to the LANL work control process, and steps taken to improve implementation through more effective training.

An assessment of IWM by the LANL Assessment Group, Audits and Assessments Division in May 2005 identified many of the same deficiencies that were identified during this Independent Oversight review. As examples: workers performing qualified-worker activities were not qualified as required by IMP-300.2; there were deficiencies in work definition, hazards analysis, and controls, including those associated with exposures to silica, sharps, noise, and inhalation of soldering fumes; and workers did not implement controls. LANL and KSL are developing a systematic approach to training to address the deficiencies identified by the Audits and Assessments organization. The LANL institutional program is scheduled to be completed in 2007, and the KSL implementing program is scheduled to be completed in 2008.

The numerous deficiencies in work controls include the deficiencies in the identification of hazards and controls that were previously identified during the 2004 LANL MSAs. Those related to KSL work have been incorporated into issues assigned to FMD, KSL, and NMT (for work at TA-55). FMD developed a corrective action plan for MSA findings related to IMP-300.2. This plan included actions to implement IMP-300.2 and to audit this implementation. Actions for implementation have been completed, but the audit has not yet been conducted. FMD management is aware of the need to improve implementation, but the FMD MSA corrective action plan does not include additional actions in this area. KSL has also developed a corrective action plan to strengthen training based on MSA findings, the Audits and Assessments IWM assessment, and comments from the Los Alamos Site Office. Completion is scheduled for 2008. NMT has separated MSA findings into management system categories and is developing plans to strengthen these management systems. Corrective action plans are still under development, and none have been completed. Although stronger management systems would improve work controls, there is no clear evidence that the planned actions would address the specific deficiencies identified during this Independent Oversight inspection.

Core Function #1: Define Scope of Work

The scope of maintenance and construction work is specified in work orders for all work performed by KSL. This scope is broken down into more detailed tasks and steps in Part 1 of IWDs for all work except for that classified as “qualified-worker” activities pursuant to IWM procedure IMP-300.2. This procedure permits work to be performed as “qualified worker activities” without defining tasks on an IWD, when those tasks are approved by the IWMC and listed on the IWM website. KSL had been using this approach for most low- and moderate-hazard work at facilities other than TA-55 but discontinued this practice for moderate-hazard work during this inspection.

In general, when tasks and steps are identified in an IWD, work is adequately defined. Independent Oversight's review of IWDs in about 30 work packages indicates that, in most cases, work is defined in sufficient detail on IWD Part 1 to support the identification of hazards and requisite controls. One exception was identified: a TA-55 preventive maintenance work package required replacement of belts and lubrication of bearings for a blower that had no belts and no bearings that could be lubricated. An ineffective pre-job walkdown contributed to this deficiency.

Tasks for qualified-worker activities were not described in most of the IWDs reviewed during this inspection. (As discussed above, this practice changed during the inspection.) These tasks are required to be listed on the IWM website and to be specifically addressed in training provided to qualified workers. However, some tasks performed by KSL under the qualified-worker program are not on the website. Notes posted on the website describe how the listed activities are to be used and state that the "list should not be considered exhaustive," implying that other activities, which are not listed, may also be performed without an Part 1 of an IWD. KSL has performed unlisted activities without an IWD Part 1. For example, excavation and trenching, which are not listed on the website, were recently performed as qualified-worker activities by KSL's small projects construction group without Part 1 of an IWD. During the trenching and excavation, a buried 480 volt line was accidentally struck and damaged. A KSL assessment identified the lack of Part 1 of an IWD as a contributing cause. The requirement to list qualified-worker activities on the IWM website assures independent review and approval of these tasks by the IWMC. Performing qualified-worker activities without this review and approval does not meet the intent of IMP-300.2 and may not provide adequate assurance of safety.

In addition, because training documentation describing the details of tasks, hazards, and controls is not always maintained as required by IMP-300.2, there is a lack of assurance that specific tasks are adequately addressed in training. LANL and KSL have developed corrective action plans to strengthen performance in this area by establishing an institutional systematic approach to training based upon job and task analyses.

Defining the scope of work in work orders is particularly important for qualified-worker activities because tasks and steps are not identified in the work package. The scope of work was adequately defined for most work observed by Independent Oversight. An exception was identified during one KSL job at a DX facility. In this case, work was not adequately defined by FMD for pump maintenance. The work order identified two leaking pumps requiring service, but the needed repair actually involved repairing one leaking pump, repairing a leaking pipe flange, and installing a pipe support. Workers repaired the leaking pump but suspended the remaining work until the work package was revised to include it.

Summary. Tasks are adequately defined when they are listed on IWDs. However, tasks associated with qualified-worker activities, which are not described in IWDs and which constitute a significant fraction of maintenance and construction work, are not always adequately defined. Qualified-worker activities are not always listed on the IWM website, and tasks associated with these activities have not been systematically analyzed to ensure that appropriate training and qualification requirements are established. During this inspection, KSL acknowledged the need for better control of qualified-worker activities and required that IWDs be established for all work except for that classified as low hazard pursuant to IMP-300.2. Limiting the application of the qualified-worker provisions of IMP-300.2 to low-hazard work, along with establishing an institutional systematic approach to training, is appropriate for improving performance in this area.

Core Function #2: Analyze Hazards

Appropriate processes are established in IMP-300.2 and in KSL implementing procedures for identifying hazards associated with KSL work activities. Criteria are established for categorizing the hazard level of planned work to support the tailoring of controls commensurate with the level of anticipated hazards. IMP-300.2 requires activity-specific hazards to be identified on Part 1 of IWDs or in training for qualified-worker activities listed on an IWM website, and requires RDLs to identify area hazards on Part 2 of IWDs. As previously discussed, KSL recently limited the application of the qualified-worker provisions of IMP-300.2 to low-hazard activities.

Most physical hazards, such as the potential for electrical shock, pinch points, injury from pressurized systems, and burns, are adequately identified and analyzed. KSL workers typically understand these hazards and are reminded of them daily during pre-job briefings. Radiological hazards are also adequately addressed during pre-job briefings, on IWDs, and on RWPs and are understood by the workforce. Although most IWDs adequately address physical and radiological hazards, this was not the case for one job observed at TA-48. In this case, Part 1 of the IWD for a sink and drain repair at a TA-48 chemistry laboratory did not identify potential injection hazards associated with radiologically contaminated sharps encountered during the repair, and appropriate controls were not included for this hazard in the work package and were not utilized.

KSL has not adequately identified and analyzed some activity-specific exposure hazards. A number of exposure hazards were not adequately conveyed to workers and were not identified with sufficient specificity to support specification of appropriate controls. As examples:

- **Welding and brazing fumes.** Installation of equipment and relocation of an emergency shower in TA-55, PF-4 required silver brazing of copper piping, but the work package did not identify brazing fumes as a hazard; thus, controls for this hazard are not specified. MSDSs for the silver brazing alloy, which was not included in the work package as required by IMP-300.2, identified toxic constituents in the fumes and recommend use of a respirator for maximum protection. The fumes were not identified as a hazard in the work package, industrial hygiene was not involved in the review of this package, and no air sampling or other formal analysis was performed to analyze potential exposures. A KSL worker required medical attention in April 2005 after experiencing dizziness as a result of exposure to fumes while brazing in TA-46, but lessons learned from this event were not incorporated into the work package. The project also included welding of stainless steel tubing and carbon steel piping, but the hazards associated with welding fumes were not addressed in the work package. The JHA tool includes hazards and controls for welding and brazing fumes but these hazards and controls were not included in the package, and a previously planned analysis of welding and brazing fume exposure hazards was not funded. After these issues were raised, KSL suspended welding and brazing without respiratory protection pending further review.

- **Silica.** Potential exposures to airborne crystalline silica, which were present at a TA-55 construction site during sawing, drilling, and coring of concrete were not identified in work packages. These activities are not included on the list of qualified-worker activities posted on the IWM website. Although controls may have been adequate to control exposures (e.g., use of water during coring to control dust), silica hazards and controls are not specified on some IWDs, and neither air sampling nor other formal exposure assessment was performed.

- **Fiberglass.** A KSL project at TA-55 included removal and installation of fiberglass piping installation. Fiberglass dust is a respiratory hazard for which respiratory protection may be needed to meet established exposure limits. However, no exposure hazards or controls were identified, and no MSDS was included in the work package.

- **Noise.** Some noise hazards were not adequately evaluated. For example, there was no survey of a DX boiler room at TA-15 to determine whether KSL workers needed hearing protection to mitigate loud noise from pumps, blowers, and compressors. Other work packages did not require hearing protection for workers using a hammer drill and metal saw in DX-3 or for drilling work in TA-55, PF-4.

RDLs have not adequately identified area hazards involving potential exposures to hazardous materials on Part 2 of IWDs. The results of analyses of area hazards are documented on standard forms for work planned pursuant to Notice 0142 and on Part 1 of IWDs for work planned pursuant to IMP-300.2. TA-55 area hazard descriptions on Part 2 of IWDs are based on the output of the JHA tool at TA-55; they are limited primarily to a description of general hazards that may be present and do not indicate activity-specific hazards. For example, a Part 2 for electrical and piping construction work inside Building PF-4, Room 107 states in part, "Other hazards that may be present are beryllium/noise/chemicals/lead/asbestos/pressure/steam lines." For a heating, ventilation, and air conditioning preventive maintenance job in the TA-55 Access building, where no exposure hazards were apparent, the work package contained a form stating, "Working near non-ionizing radiation, beryllium, noise, chemicals, hazardous biological materials, lead, asbestos, temperature/humidity extremes or high explosives." Area hazard descriptions for KSL work at TA-48 were equally general. Such general descriptions of exposure hazards are not adequately tailored to planned work activities and are of little value to workers. More effective interface between KSL and facility owners is needed during work planning to better define work area exposure hazards for KSL workers. Additionally, errors in KSL work package for a TA-48 scaffold assembly/disassembly job resulted in incorrect area hazards being conveyed to workers. The work package was issued and approved for work with the wrong IWD Part 2 area hazards; this discrepancy was noted by the Independent Oversight team and the pre-job brief, and work was postponed pending reissue of the work package. The work package contained an approved IWD Part 2 for Room 332 of the hot cell, not for Room 322 where the work was to be conducted. Area hazards in Room 322 are different from those in Room 332. The room difference was not identified by work planners, supervisors, or workers, even though previous work had been performed using this package.

Finding #11. KSL has not ensured that potential exposures to hazardous materials are adequately identified or analyzed as required by DOE Order 440.1A.

Summary. Activity-specific radiological and physical hazards are, in general, adequately identified and understood by KSL workers, However, potential hazards associated with exposures to hazardous materials are not always fully analyzed and are not well understood by the workforce. A finding from the 2002 Independent Oversight inspection addressed a similar deficiency associated with programmatic work at Chemistry and Metallurgy Research. Increased involvement of ES&H SMEs is needed to improve performance in this area. (See Finding #3.) The need for more effective review of work packages by KSL safety engineers was acknowledged, but no definitive corrective actions had been developed for this area. In addition, area hazards are not sufficiently specified for planned KSL activities. More effective interface between KSL and RDL staffs is needed to better describe area hazards that KSL workers may encounter.

Core Function #3: Identify and Implement Controls

A number of controls have been established to ensure mitigation of hazards during KSL work activities, including training, procedures, and special permits. Most of these controls are included in IWDs and training, and KSL workers are reminded of them daily in pre-job briefings. Additional controls include monitoring and assessments by LANL line management and KSL safety professionals.

IWDs specify the training that is required before each work step is performed, and training records indicate that assigned KSL workers have consistently received this training. For qualified-worker activities performed without IWD Part 1, IMP-300.2 requires training documentation that includes "details of the tasks, hazards, and controls" covered by the training and references LIR 300-00-04, which further requires that qualifications be based on written tests, oral tests, or operational evaluations. As previously discussed, the training required for qualified-worker activities has not always been completed, and training documents do not always verify that adequate training was provided. Assessments by the LANL Assessments group and by KSL have determined that these training and qualification requirements have not been met for KSL qualified-worker activities. In particular, qualification determinations have not always been based on written tests, oral tests, or operational evaluations, and IWM training required by Section 7 of the procedure is incomplete. In addition, this Independent Oversight review identified that training documents do not always provide the details of tasks, hazards, or controls needed to ensure that workers are adequately trained to work without IWDs. An ongoing review by the Assessments group has identified this same deficiency. An observation by Independent Oversight illustrates how such training deficiencies may limit the effectiveness of the qualified-worker program. Specifically, Independent Oversight observed a zero voltage check on a 480 volt circuit at TA-48 by an electrician who was not wearing a dielectric flash hood as required by National Fire Protection Association (NFPA) 70E. The electrician was considered to be a qualified worker and was working without a Part 1 IWD, and the course documentation did not indicate whether the requirement for a hood was taught. The same job was performed using an IWD at TA-55 by an electrician who was wearing the hood in accordance with the control listed on the IWD.

Adequate procedures have been developed for the control of KSL maintenance and construction activities. IMP-300.2 provides an adequate process for controlling KSL maintenance and construction work and allows user organizations to tailor this process to suit their needs. Implementing procedures issued by FMD, and by NMT for TA-55, provide appropriate tailoring for work performed by KSL. Workers are authorized by procedure to stop work when new hazards are encountered or if they question the safety of planned activities for any reason. They are reminded of this authority, and of the expectation that they will use it, in training and pre-job briefings.

Permits have been used effectively to control hazardous work. Permits are referenced by IWDs and were used when required for observed KSL work activities. RWPs specified PPE, dosimetry, and monitoring requirements that were appropriate for the radiological conditions at the job site. Spark or flame producing operations permits and excavation permits were issued when required. Confined space permits were issued when required, but the required information was not always recorded on the forms. For example, a steam line replacement work package for TA-46 contained three confined space entry permit forms that lacked information on the air monitoring equipment, the authorized user, individuals monitored while in the space, monitoring data, and permit closure and termination. Furthermore, craft workers who perform confined space air monitoring have not been provided formal training and there are no specific requirements for such training.

Craft foremen were typically present at the KSL job sites visited by Independent Oversight, and supervisors expressed a thorough understanding of the work that was being performed. KSL safety engineers and industrial hygienists also provide support to the craft when requested, but expectations for proactive safety monitoring and reviews by these safety professionals have not been established. Radiological controls were appropriate for the observed work. RCT coverage and radiological surveys were adequate, and radiological controls were appropriately conservative. Conservative controls were particularly evident during repair of a closed cooling water heat exchanger in TA-55, PF-4. The internal surfaces of the heat exchanger were assumed to be contaminated, and respirators were required during opening of the system even though no radioactivity was detected in water samples from the heat exchanger. The use of conservative controls was appropriate because contamination was found on internal surface of the heat exchanger.

Summary. When hazards are identified in IWDs, appropriate controls are also specified in the IWDs and are implemented. The specified controls are consistent with regulatory requirements and LANL procedures. An appropriate set of work control procedures has been established, and permits are used when required. However, for qualified-worker activities that do not specify controls on IWDs, training documentation is not always sufficient to demonstrate that controls were taught in the required training, and appropriate controls were not established in a few cases. The planned implementation of a systematic approach to training by KSL is appropriate to address this deficiency.

Core Function #4: Perform Work Within Controls

All observed work was properly authorized prior to commencing work. Work orders were reviewed by the KSL maintenance superintendents, issued to the person in charge, and approved by the respective facility point of contact or operation center supervisor before work began. With one exception, pre-job briefings appropriately covered the work package and IWD requirements in sufficient detail to inform workers of the potential hazards and required controls associated with their respective assigned tasks. One pre-job briefing (for repair of a sink drain in TA-48, RC-1) was conducted without industrial hygiene in attendance, even though the IWD included a note that “IH Personnel and RCTs are required at the Pre-job Briefing.”

Workers at TA-55 and DX complied with all controls that were clearly identified in management requirements documents, procedures, work orders, or work packages. When there were specified work steps in work packages, the work was usually conducted in accordance with those steps. However, in one case a KSL person in charge of a corrective maintenance task on the TA-55, PF-4 elevator performed a lockout/tagout out of sequence. Although this particular change provided increased safety, administrative controls were not followed for the field change to the work package in accordance with procedures. Other work observations indicated that lockout/tagout was appropriately used to de-energize electrical equipment and isolate other hazardous energy sources at several TA-55, TA-48, and DX facilities.

Scaffolding at TA-55 was appropriately constructed, inspected, and tagged prior to use; however, a ladder inspection at TA-48 was not conducted before use, even though the IWD required workers to “Inspect ladder prior to use and confirm the annual ladder inspection is current.” In addition, an inspection sticker on the ladder indicated inspection was past due, and use of the ladder continued after Independent Oversight informed the person in charge and the maintenance superintendent about these deficiencies. Subsequent investigation by KSL revealed that the ladder had been recently inspected but the documentation had not been updated.

Identified PPE was used when required, with some exceptions. Radiological controls for the KSL sink and drain repair at a TA-48 chemistry laboratory were observed to be appropriately applied at the activity level. Workers followed the requirements of the assigned RWP, including proper PPE and good contamination control techniques during numerous donnings and doffings of PPE. RCT job coverage was continuous, as required by the RWP, and sufficient radiological monitoring of the worker, tools, and generated waste was maintained. However, some IWD requirements were not followed during a KSL sink and drain repair at a TA-48 chemistry laboratory. During removal of a drain trap in a chemical lab sink, the obstruction was identified visually to be broken glass pipette tips and capillary tubes. The potential injection hazard associated with the handling and disposal of these radiologically contaminated sharps was not included in the IWD, and activity-specific information and appropriate PPE or disposal containers for sharps were not available or used. The IWD for this task contained a statement that "If any hazards are identified that are not described on this screening, STOP WORK and contact the FC." Work was not stopped, and no additional PPE or needed equipment, (e.g., leather gloves, sharps disposal container) was considered. In addition, as discussed above, appropriate flash protection PPE was not utilized in accordance with NFPA 70E or LANL training for troubleshooting a 480 volt motor control center at TA-48.

Another difficulty evident in the troubleshooting of this motor control center was insufficient lighting. Workers had to use a flashlight while working on an electrical control panel with sparse lighting, resulting in awkward handling of both tools and the flashlight. The IWD Part 2 for this area contained in the work package identified "Poor lighting" as a work area hazard and specified as a preventive measure "Use additional setups of halogen lighting to bathe area in sufficient lighting." However, this control was not followed.

Summary. All work was properly authorized before commencement. In many cases, when controls were clearly identified, workers implemented those controls during the course of work. However, there were several instances where procedures were not followed in the areas of lockout/tagout, ladder inspections, lighting, and control of sharps. In addition, improvements are needed in stop-work implementation when new hazards or situations that could impact safety are encountered, especially when such conditions require IWD revision or implementation of additional work planning or controls to protect workers. Most of the deficiencies identified during this review had been previously identified but not adequately corrected.

C.3 Conclusions

LANL has made progress in some areas, such as continuing efforts to develop and implement the IMP 300.2 procedure, as a result of their efforts to address previously-identified deficiencies. However, in many cases, the previous deficiencies are still evident because corrective actions are not complete, not comprehensive, or not effective. Further, there are a number of deficiencies in institutional safety management systems, including weaknesses in implementing IMP-300.2 and a continuing lack of SME involvement in identifying and analyzing hazards.

Significant work control accomplishments are evident in C-Division since the completion of the MSA. IWDs are numerous and, in general, adequately identify work/research tasks, hazards, and controls. The staff is knowledgeable of the hazards and controls within their workspaces, and all work that was observed was performed safely. Engineering controls within the C-Division laboratories are well designed and effective. However, much remains to be done. For example, C-Division is not fully compliant with IMP-300.2, although there is skepticism within C-Division about whether compliance with IMP-300.2 will improve worker safety. SMEs (e.g., industrial hygiene, industrial safety, and medical) are not sufficiently involved in planning some research activities. A structured OJT and mentoring process has not been developed for the research and shop staffs. Some hazards have not been adequately analyzed, and some work areas hazards within a laboratory have not been adequately communicated among the various groups working in the space. Line managers have not consistently verified that workers are adequately trained before performing work, in part because of inadequate division-level and/or institutional-level training programs and databases. Some of these concerns were causal factors in recent accidents within C-Division, and a number of these concerns may require both institutional and C-Division corrective actions. All of these deficiencies had been previously identified during the C-Division MSA, recent LANL Audits and Assessment Division assessments, or the 2002 Independent Oversight inspection. However, the outstanding corrective actions from these previous assessments (in particular the C-Division MSA) are numerous and extensive, and most have not yet been completed.

Many aspects of DX implementation of Core Functions #1 through #4 are effective. Existing work documents, project plans, and work schedules adequately define the scope of work for most current DX activities. The IWM process adequately addresses identification and analysis of hazards, and in most cases, DX appropriately implements the requirements. In most cases, appropriate controls are established and implemented for recognized hazards. Most observed DX work was appropriately verified as ready, authorized, and performed within established controls. Although most DX hazards analyses and controls were appropriate, Independent Oversight observed a few deficiencies in LANL institutional guidance for development of IWDs, inclusion of environmental and waste management hazards in DX IWDs, performance of industrial hygiene baseline hazard surveys, and performance of work within established controls. In addition, many workers still are not aware of the benefits of the IWM process and expressed the belief that IWDs did not improve safety or, in some cases, actually decreased safety by shifting focus from safety analysis to an administrative exercise. Management attention in these few areas is needed to optimize implementation of the IWM process and ensure acceptance of the process by DX personnel.

NMT and TA-55 have generally robust processes and systems to plan and control programmatic work. These include the use of process hazards analysis, HCPs, work instructions, manufacturing work instructions, and IWDs. Hazard identification and analysis processes are generally effective; however, analysis of some chemical hazards and radiological hazards for non-routine isotopes, such as neptunium, is not rigorous enough to ensure adequate controls. NMT has striven to maintain historical work control processes (HCPs, work instructions) while also expending significant effort to comply with new institutional requirements as they evolve, such as Notice 142 and IMP-300.2. Overlap and perceived duplication of information have been a source of continuing frustration within NMT, and the multitude of requirements has not always resulted in clear work authorization documents. Existing HCPs, work instructions and IWDs either conflicted or lacked sufficient detail about hazards and controls at the task level. Similar concerns were identified in the 2002 Independent Oversight inspection and 2004 MSAs. Some groups and division office management have improperly used the qualified-worker provisions of IMP-300.2 without meeting the specific requirements and necessary institutional authorizations. NMT practices for planning and scheduling programmatic work through a formal plan-of-the-day/ week process does not meet site conduct of operations requirements and has not adequately addressed some programmatic operations that could impact outside groups, such as HSR. While the radiation protection program at TA-55 is generally sound, deficiencies were identified in several areas, such as hazards analysis, radiological work documents, radiological monitoring and surveys, and posting.

The LANL work control process has improved and provides an adequate framework for controlling KSL maintenance and construction work, but some implementation deficiencies were observed. Potential exposures to hazardous materials are not always adequately addressed in Part 1 of IWDs, and area hazards identified in Part 2 of IWDs are not always adequately tailored for planned work. The qualified-worker provision of IMP-300.2 was prematurely and incorrectly implemented by KSL before a supporting training program was established. Corrective actions taken and planned are appropriate to address some of the identified deficiencies. The recent restriction of the qualified-worker program to low-hazard activities is appropriate in view of the weaknesses in the supporting training program. The planned implementation of a systematic approach to training is needed to support application of this program to higher-hazard work. Increased involvement by ES&H SMEs is needed to assure that exposure hazards are more effectively identified and controlled, and a more effective interface between the RDL and KSL is needed to better tailor area hazards to planned work. The Independent Oversight review in 2002 identified weaknesses in the work control process and implementation. The process has been strengthened since then, but some of the same implementation deficiencies remain. In particular, both the 2002 review and this 2005 inspection identified that required personnel did not always attend pre-job briefings, craft personnel did not always comply with work instructions, and some exposure hazards were not adequately identified or adequately analyzed to ensure that worker exposures were within limits.

C.4 Ratings

The ratings for the first four core functions are presented separately for the activities reviewed to provide Los Alamos Site Office and LANL management with information on the effectiveness of organizations and the implementation of the various core functions.

LANL ACTIVITY	CORE FUNCTION RATINGS			
	Core Function #1 – Define the Scope of Work	**Core Function #2 – Analyze the Hazards**	**Core Function #3 – Identify and Implement Controls**	**Core Function #4 – Perform Work Within Controls**
Chemistry Division	Effective Performance	Significant Weakness	Needs Improvement	Effective Performance
Dynamic Experimentation Division	Effective Performance	Needs Improvement	Needs Improvement	Effective Performance
Nuclear Materials Technology Division	Effective Performance	Needs Improvement	Needs Improvement	Effective Performance
Facility Maintenance and Construction Work Performed by KSL	Needs Improvement	Needs Improvement	Effective Performance	Needs Improvement

C.5 Opportunities for Improvement

This Independent Oversight inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

LANL - Institutional

1. **Provide additional guidance and definitions for the IMP-300.2 process**. Specific actions to consider include:

    - Provide clear definitions and limits on use of “standing IWD” and “qualified worker.”
    - Provide training on the benefits of the IWM process for program work.
    - Provide more details and guidance on implementation of and tailoring individual IWDs to hazards unique to the jobs.
    - Provide instructions and guidance on developing controls for potential hazards as well as actual or anticipated hazards. Encourage the use of stop-work authority as a control for potential but unexpected hazards.
    - Streamline the revision process for IMP-300.2 to better incorporate lessons learned from initial implementation in program divisions.

2. **Continue efforts to develop and implement a systematic approach to training**. Reexamine priorities to determine whether this initiative can be completed sooner than the current 2007 scheduled date. Train workers on hazards and controls for specific tasks, and include information equivalent to that required on IWD Part 2 in training documentation as evidence of this training.

3. **Clarify expectations for control of qualified-worker activities**. Specific actions to consider include:

    - Establish criteria for use by line organizations and the IWMC for classifying planned work as qualified-worker activity.
    - Specify requirements for IWMC review and approval of proposed qualified-worker activities.
    - Limit the use of qualified-worker activities to those specifically approved by the IWM coordinator and posted on the website.

4. **Establish an institutional committee on chemical hazards to provide guidance on chemical selection, use, control, hazards analysis, and training.**

5. **Use the RDL Council, working with FMD and KSL, to strengthen the interface between RDLs and KSL to ensure that area hazards identified on Part 2 of IWDs are appropriately tailored to planned KSL work activities.**

C-Division

1. **In coordination with HSR, review all C-Division radiological contamination control practices, develop an appropriate technical basis for radiological controls, and ensure compliance with institutional LIRs, radiological control procedures, and regulatory requirements.** Specific actions to consider include:

   - Using results of the review of researcher radiological contamination control practices, develop a technical basis for instrumentation used by researchers. Determine whether the instrumentation meets Minimum Detectable Activity requirements for radiological monitoring of lab samples or other materials for release to uncontrolled areas, including qualitative measurements using field counting survey instruments (as compared to a more quantitative analysis via low background counting). Correct any deficiencies and/or establish justification for any anomalies.

   - Coordinate with radiation protection SMEs to determine whether current radiation control practices, which require the existing routine surveys conducted in unrestricted areas, are sufficient or require greater detail or increased frequency.

   - Review RC-1 radiological control procedures against the LANL institutional radiation protection requirements for control of radioactive materials to ensure compliance, and revise as necessary.

2. **Reassess, prioritize, and implement the remaining open corrective actions for C-Division.** Specific actions to consider include:

   - Emphasize open corrective actions resulting from the C-Division MSA; corrective actions from recent accidents, events and near-misses within C-Division (such as the 2004 laser accident and the most recent acid-gas event); and work management and laser corrective actions identified by the Audits and Assessment Group.

   - Develop and implement risk-ranking or prioritization techniques.

   - For corrective actions with long lead times for completion, develop interim compensatory actions.

   - Focus on specific areas that were again identified by the Independent Oversight team, including:

     – Working outside the established safety envelope, which was a contributing factor in the laser and acid vapor inhalation accidents

     – IWDs that do not adequately describe the hazards and/or controls

     – Hazards that are not sufficiently analyzed

     – Area workplace hazards that are not identified or communicated to others in the workspaces, or for which there is no single point of responsibility or ownership

     – Lack of a plan to implement IMP-300.2

     – Insufficient involvement of ES&H SMEs in work planning

     – Radiation surveys that are not sufficient to detect and limit the spread of low-level radiological contamination

     – Need for a structured mentoring process for the research and shop staffs

     – Increased rigor in revising and updating IWDs to accommodate changes in work scopes, hazards, and/or controls.

3. **Assess the effectiveness of previously closed corrective actions.** Place particular emphasis on the closed corrective actions for C-Division-related issues previously identified during the C-Division MSA, corrective actions from the 2004 laser accident and the most recent acid-vapor inhalation event, and work management and laser corrective actions identified by the Audits and Assessment Group.

DX

1. **Continue to develop ways to increase efficiency, productivity, and consistency in the development and implementation of IWDs**. Specific actions to consider include:

    - Require external customer requests for shots to include a detailed, documented scope of work.
    - Require all DX shot plans to include a detailed description of the scope of work.
    - Expedite development of the revised high explosive worker training program, complete definition of required training for the six categories of these workers, and populate the training tracking database with this information.
    - Require all DX IWDs to include a documented, sequential procedure to facilitate hazards identification, identification of procedure steps where specific (rather than general) hazard controls must be invoked, and consistency of implementation during work performance.
    - Limit the lead experimenters' discretion in specifying the list of DX shot plan and IWD reviewers by establishing a minimum set of SMEs required to review and concur in all these documents, thereby improving the opportunity to identify all hazards and establish appropriate controls.
    - Improve the use of IWDs to address hazards common to most or all jobs within an area, room, or facility.
    - Increase the focus of individual IWDs on the hazards unique to the specific job.
    - Increase the use of separate approaches to anticipated hazards and potential but unanticipated hazards (e.g., use of stop-work as an administrative control for unanticipated hazards).
    - Ensure that environmental and health hazards are addressed with the same rigor as safety hazards.
    - Increase the use of industrial hygiene surveys to establish exposure action levels (e.g., for noise and magnetic fields).

NMT TA-55

1. **Increase the emphasis on migration of NMT work activities and Notice 142 IWDs to IMP-300 standards.** Specific actions to consider include:

    - Revise NMT-AP-045 to more accurately reflect requirements for qualified-worker status and use of Notice 142 work control documents.
    - Ensure that NMT-AP-045 contains sufficient instructions for implementing all IMP-300.2 requirements for qualified-worker status and specificity of controls. For example, the procedure for site IWM acceptance and placement of activities on the institutional website and the process for certifying Notice 142 IWDs as IMP-300 compliant should be defined.
    - Conduct special training of NMT group personnel to ensure adequate understanding and consistent application of requirements across groups.
    - Develop review criteria to be used as a basis for evaluating existing work control documents against IMP-300.2 requirements.
    - Conduct a systematic review of all authorized work control documents to ensure compliance with IMP-300.2. Revise as necessary. Maintain records of review findings.

2. **Improve the consistency and specificity of hazards and controls across work documents and ensure that IWDs reflect all hazards and controls consistent with IMP-300.2 requirements.** Specific actions to consider include:

   - Reduce the reliance on generic IWDs and work instructions by preparing task-specific IWDs that identify specific hazards and controls.

   - Avoid references to other documents or regulations in specifying controls, and instead extract and list the specific controls applicable to the work.

   - Avoid the use of subjective controls (such as "use good practices" and "time, distance and shielding") and replace with specific controls applicable to the work.

   - Avoid the use of generic controls (such as "RCT Coverage" and "surveys") and replace with specific criteria such as "RCT coverage when extracting Am salts" or "surveys required when dose rates may exceed 50 mR/hr at glovebox window."

   - Eliminate duplication and the potential for inconsistencies by using the IWD as the main work document specifying hazards and controls, with other documents attached or referenced as necessary.

3. **Increase line awareness of special hazards and controls needed for certain chemicals and non-routine isotopes that may be processed in TA-55, and ensure adequate SME involvement in the work planning process.** Specific actions to consider include:

   - Revise the TA-55 health physics questionnaire to include a checkbox for "other" isotopes that require evaluation by HSR-1.

   - Conduct special training for staff on the unique hazards and controls that may be needed for non-routine isotopes.

   - Establish a mechanism that ensures implementation of the requirement for HSR-1 review and approval of radiological work control documents, including HCPs.

   - Establish thresholds for required industrial safety and hygiene review and participation in work planning, including review and approval of IWDs and other work control documents.

4. **Ensure that HCPs and/or other radiological work control documents that are used instead of RWPs contain the level of radiological information and detail required of an RWP, consistent with LIR requirements.** Specific actions to consider include:

   - Conduct special training of division staff responsible for preparing HCPs and work instructions to ensure that they are aware of LIR requirements.

   - Determine the root cause for failing to properly address this MSA finding.

   - Review and revise current work documents to ensure that they meet LIR requirements.

   - Implement a mechanism to ensure implementation of the requirement for HSR-1 review and approval of radiological work control documents.

5. **Increase awareness of radiation levels during programmatic activities performed in radiological areas, and improve posting and contamination monitoring practices.** Specific actions to consider include:

   - Revise TA-55 procedures to increase the frequency of routine radiation surveys in radiation areas to meet the requirements of ESH1-06-01.2, or provide justification for any significant variance.

   - Revise HSR documents to clarify requirements for external exposure surveys during radiological work. At a minimum, workers should be aware of and be able to articulate the total dose rates for the materials being used, whether workers perform surveys on their own or HSR conducts the surveys. Work documents should also provide anticipated dose rates, consistent with an RWP (see item 4, above).

- Consider modifying the current TA-55 plan-of-the-day format to include all programmatic work where line managers briefly review all planned work, including any operations that may require HSR review or involvement, per TA-55-RD-555.

- Ensure that radiation area postings are placed at a location that precedes entry into a 5 mrem/hr or greater field, and utilize LANL-approved signs throughout PF-4.

- Increase the frequency and documentation of quantitative smear measurements to supplement routine large area swipes in PF-4 labs.

- Expand group and facility work instructions to provide better and more specific requirements for down-posting airborne areas, doffing respiratory protection, and similar functions.

LANL-FMD

1. **Ensure that common exposure hazards, such as fumes created by welding, soldering and brazing; airborne silica generated during concrete sawing, drilling, and coring; and noise produced during use of specific power tools are adequately analyzed.** Hazards analyses and required controls should be documented and made available to laboratory and contractor employees for reference on IWDs.

2. **Strengthen hazards analysis processes by ensuring that planners have the training necessary for exposure hazard identification, by providing a more systematic approach to worker training, and by instituting a more effective review of planned work by ES&H SMEs.**

KSL

1. **Continue to restrict the performance of qualified-worker activities without IWD Part 1 to low-hazard activities until a systematic approach to training has been established.**

2. **Clarify expectations for involvement of KSL safety engineers and industrial hygienists in the planning and conduct of hazardous work.** Focus attention on improving the identification and control of exposure to hazardous materials.

3. **Identify required training by course numbers as well as titles on IWDs to assure that the intended training requirements are met.**

4. **Require managers to more carefully review completed permits to ensure that the required documentation is complete.**

5. **During pre-job briefings, emphasize the importance of following the requirements in IWDs and following the established procedures for changing these requirements when changes are needed.**

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

D.1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight (Independent Oversight) team evaluated contractor feedback and improvement processes at the Los Alamos National Laboratory (LANL). The Independent Oversight team examined two areas:

- The LANL process for managing issues identified during the resumption effort, with emphasis on selected operational efficiency elements (i.e., safety basis, the integrated work document process, and conduct of engineering), the corrective action review board (CARB), and local (i.e., division- or group-specific) corrective action plans (see Section D.2.1).

- LANL feedback and improvement processes, such as the contractor assurance system (CAS) assessments, corrective action and issues management, injury and illness investigation and prevention, lessons learned, the employee concerns program, and institutional processes. Independent Oversight focused on the organizations assessed through the evaluation of core function implementation for work activities and safety systems. These included the Chemistry (C) Division, the Dynamic Experimentation (DX) Division, the Nuclear Materials Technology (NMT) Division, and organizations and subcontractors responsible for facility maintenance work (i.e., Facility Management Division [FMD] and KSL) and safety bases (see Section D.2.2).

Independent Oversight also interviewed LASO and LANL personnel and reviewed various program documents and assessment reports. As discussed in Appendix F, Section F.2.5, safety system oversight, a feedback and improvement element, was reviewed as a focus area.

D.2 Results

D.2.1 LANL Processes for Managing Resumption Issues

Background on Resumption Effort

DOE and LANL investigations of a number of security- and safety-related events identified concerns about organizational cultural issues related to implementation of safety and security management. The LANL Director suspended most LANL operations on July 16, 2004 (a few regulatory-driven or otherwise essential activities were allowed to continue). LANL, in coordination with the Los Alamos Site Office (LASO), developed a detailed resumption plan for its research, development, and facility activities. The resumption plan called for each organization to complete a comprehensive management self-assessment (MSA) and verify readiness for each LANL activity through a laboratory readiness review (LRR). The degree of rigor in the assessment/verification process and the level of management approval for restart was based on the risk level. The LANL Director's approval and LASO concurrence needed to be obtained before operations were allowed to resume.

Independent Oversight provided support to LASO during the resumption effort. Independent Oversight's experience indicated that the MSAs and LRRs were a valuable learning experience in self-evaluation and identified many weaknesses and deficiencies in safety processes and performance. Independent Oversight also determined that the corrective actions resulting from the resumption effort, if implemented rigorously, had the potential to result in better safety processes and improved safety performance.

The LANL resumption effort identified over 2500 individual findings or substantive observations. Of these, over 400 were categorized as requiring disposition before activity restart, and approximately

500 were identified as issues to be addressed at an institutional level. LANL organizations developed local corrective action plans (LCAPs) for their post-restart findings and substantive observations, and the institutional issues were rolled into existing LANL initiatives and associated corrective action plans. Approximately 1600 post-restart resumption corrective actions have been developed; more than half of these actions have been completed, and the remainder are being tracked to closure in the LANL corrective action system, called I-Track.

LANL tailored its normal issues management processes (discussed in Section D.2.2) to track the numerous issues (e.g., findings) and the large number of individual corrective actions resulting from the resumption effort. Accordingly, LANL developed and implemented a number of specific processes for managing resumption issues.

Independent Oversight selected three important LANL resumption elements for review: the operational efficiency project, the CARB, and the LCAPs. These elements and Independent Oversight's observations are discussed on the following subsections.

Operational Efficiency Project

The operational efficiency project was initiated before the stand-down to address eight broad, institutional focus areas that LANL management determined to represent some of the highest risks and to warrant the most attention from an institutional level: safety, quality assurance, software quality assurance, conduct of engineering, safety basis, operations, environmental risk management, and training. LANL determined that the resumption effort identified many of the same issues. Independent Oversight evaluated the operational efficiency process and focused on selected focus areas and specific elements within those focus areas – safety (e.g., integrated work management), operations (e.g., conduct of operations), conduct of engineering (e.g., configuration management), and safety basis (e.g., the unreviewed safety question process) – to evaluate implementation of the operational efficiency project.

The operational efficiency project has strong support and visibility with LANL senior management. This project is adequately described in the Operational Efficiency Project Execution Plan (dated March 2005) and identifies a number of institutional activities that are crucial to improving safety at LANL. It uses modern project management tools to track progress on the actions items for the eight functional areas.

The operational efficiency project has contributed to improvements to institutional programs in a number of areas of longstanding need. In the area of operations, the operational efficiency project was instrumental in establishing institutional requirements for a conduct of operations program and issuing the LANL institutional conduct of operations manual. In addition, a task force formed under the auspices of the operations element of the operational efficiency project recommended the development of a new approach, which is being implemented to enhance the facility safety management process at LANL. In the area of conduct of engineering, some improvements have been made in institutional programs, such as the development of standardized administrative procedures for certain engineering activities.

Although some institutional-level progress has been made, the operational efficiency project has had limited success in driving improvements down to the facility and activity level and in ensuring effective implementation by line management. Based on Independent Oversight's review of relevant safety management processes (e.g., integrated work management, conduct of operations, configuration management, unreviewed safety questions) at the facility and activity level (see Appendices C and E), the operational efficiency project has not yet had a major impact at the facility and activity level. For example, the organizations reviewed during this Independent Oversight inspection had varying approaches to implementing the IMP-300 requirements, and some organizations had no clear plans or milestones for implementing IMP-300 requirements. As another example, there are no clear requirements for involving subject matter experts (SMEs) in identification and control of hazards, and there are no milestones to address this important deficiency, which was identified as a weakness in a number of internal and external assessments, including Type B accident investigations and the 2002 Independent Oversight inspection. (See Findings #1, #2, and #3.)

A number of factors have contributed to the slow progress in driving improvements to the facility and activity levels. First, LANL has not established sufficient institutional drivers that require timely implementation of some important institutional initiatives. For example, LANL did not ensure that divisions developed adequate implementation plans and upgraded their processes and integrated work documents (IWDs) to fully meet IMP-300 requirements. In addition, while the IMP-300 document provides an adequate framework for a work control process, LANL management has not established expectations that divisions and facilities develop specific implementing procedures to tailor IMP-300 to their specific needs. Furthermore, no additional guidance documents have been promulgated as part of the issuance of the IMP-300. As another example, the conduct of engineering project has developed institutional procedures, but there are no requirements or milestones for adopting or implementing those procedures at the division level. The approach used to decide on the schedules for adoption of these procedures consists of cumbersome negotiations between the operational efficiency project and the divisions.

A second and related factor is that LANL management has not devoted sufficient attention to establishing a clear chain of responsibility and accountability for corrective actions, extending from the institution to the division, facility, and activity levels. One of the major attributes of the resumption process was the establishment of a chain of responsibility and accountability for identifying, evaluating, reviewing, verifying, and approving findings and pre-start corrective actions. This chain of responsibility and accountability included the MSA/LRRs review teams, team leaders, responsible line managers, responsible division leaders, division directors, and LANL's Associate Laboratory Directors. This chain of responsibility and accountability was described in the resumption process program plans and included a provision for Associate Directors to certify that actions were complete and met safety and security objectives. During the transition from pre-start resumption activities to post-start activities (e.g., development and implementation of corrective action plans), LANL underwent continuing reorganizations and management changeovers and lost its focus on maintaining and monitoring a clear chain of responsibility and accountability for the resolution of findings and timely and effective completion of corrective actions. As discussed in Appendices C and D, in a number of cases, milestones have been missed, pre-start issues have recurred, corrective actions have been delayed or not completed, and/or corrective actions have not been verified to be effective. Some of these concerns can be attributed to insufficient focus on a chain of responsibility and accountability for ensuring that corrective actions are addressed and that individuals who are assigned to develop and implement specific corrective actions have the requisite authority and resources.

A third factor is the lack of rigorous processes for the operational efficiency project integrated project team leaders to use in determining or verifying the effectiveness of elements implemented by the divisions or by organizations within divisions. The project has typically relied on verbal feedback from line management to establish implementation progress; this feedback has not been based on formal assessment and verification that processes are established in procedures or work instructions, that managers and workers have been trained and understand process expectations, and that procedures have been effectively implemented in the field. Although the Audits and Assessments organization also performs assessments of institutional processes and implementation by line and support organizations, their resources can not support timely validations for all operational efficiency projects and sub-projects. However, recent Audits and Assessments reviews typically have identified deficiencies in implementation of several institutional programs that were restructured through operational efficiency projects, such as for integrated work management (IWM) and safety basis. (See Finding #13.)

A fourth factor is that some of the activities performed under the auspices of operational efficiency have not always been clearly defined or implemented. For example, in the safety basis element, the project coordinated an effort to review past unreviewed safety question (USQ) determinations but did not first establish whether the initial USQ screening process was adequately implemented, an area where many problems have been identified throughout the DOE complex. The Independent Oversight team identified deficiencies in this area at LANL during this inspection (for more details, see Appendix E).

Based on interviews with LANL management and the Operational Efficiency Project Manager, the project managers and team leaders have clearly recognized the need for implementation drivers and stronger monitoring of implementation status at the division level. Earlier this year, the project manger developed plans for performing division-level reviews and completing them by October 2005. However, LANL management then decided they needed to collect a broad range of information about implementation more rapidly. Rather than institutionalizing a formal process, they implemented an informal "scorecard" process that will be an ongoing element of the operational efficiency project. This process was designed to collect information from all divisions simultaneously about the implementation status of all of the operational efficiency functional areas and was based on criteria and guidance developed by the project team. While the scorecard process provided a large amount of information (including organizational implementation plans to close the gaps identified in the exercise), its effectiveness has been limited by weaknesses in the criteria and guidance provided to the divisions. There was no clear direction and no expectations that the scoring would be based on field reviews of documents or observations of work. As a result, scorecard reports typically reflected opinions or desktop analysis rather than validated performance assessment. For example, the criteria for measuring IMP-300 implementation do not address whether existing IWDs and hazard control plans have been upgraded to meet IMP-300 requirements. As discussed in Appendix C, Independent Oversight determined that many IWDs for the C and NMT Divisions have not yet been upgraded to meet IWM requirements, and in some cases clear milestones for their upgrade have been established.

Corrective Action Review Board

During the resumption effort, LANL used a Readiness Review Board, consisting of senior LANL managers and LASO representatives, to review each organization's MSA and corrective action plan. The Readiness Review Board was the primary management tool for determining readiness to resume operations.

LANL established the CARB in February 2005 as a longer-term measure to perform a similar role in reviewing resumption issues and corrective actions. This CARB consists of LANL managers and staff appointed by the LANL Director, as well as a LASO senior staff member. In addition, many members of the current CARB, including its chairperson, have served on the Readiness Review Board and have other experience in managing complex safety issues, providing significant and relevant experience in evaluating LCAPs and their implementation.

The major focus of the CARB is to ensure that LCAPs are properly developed and appropriately implemented. The CARB is also tasked to review broader institutional issues, including those managed by the operational efficiency project and the Institutional Assurance Board (IAB). The CARB is expected to focus on root causes behind the issues, analyze the collective significance of the issues, and determine whether more comprehensive corrective actions are needed. Independent Oversight evaluated the CARB by examining its policies and procedures and by selectively examining the initial CARB reviews of LCAPs.

In general, CARB operations are formal and well documented. The CARB charter clearly describes its missions, its membership, and the roles and responsibilities of CARB members. Formal documents, such as the CARB procedure for reviewing corrective action plans for resumption of Risk Level 2 and 3 activities, provide meaningful instructions for the scope of the review, comment resolution, and corrective action change control. Another CARB procedure provides comprehensive checklists for reviewing corrective action plans and verifying that corrective actions are adequate, that causal analysis has been conducted where required, that actions address the issues, and that there are adequate plans to assess the effectiveness of completed actions. The procedures also address reviews of high- and/or medium-significance issues and analyzing issues that may not be significant individually but may have significance when considered in aggregate. Development and application of standard checklists and criteria for reviewing corrective action plans, as instituted by CARB, aid the uniformity and the rigor of the review process.

The CARB is a positive step and performs a needed function. However, as discussed in the next subsection, it has only begun to perform its main function; to date, most of its efforts have been spent developing the needed processes/procedures and assembling the teams. Continued management attention will be needed to ensure that the CARB process is effectively implemented and sustained.

Local Corrective Action Plans

Most of the approximately 2500 issues identified in the resumption effort are being managed through a large number of LCAPs. The LCAPs were developed by various organizations within LANL to address the remaining local issues and institutional issues with local components.

To accommodate the process for managing resumption issues, LANL developed a separate procedure (DI 05-001) to complement LANL's issues management process as defined in laboratory implementation requirement (LIR) 307-01-05 and its accompanying laboratory implementation guide (LIG). The separate resumption procedure provides specific requirements for developing corrective action plans, seeking approval, and validating/verifying the effectiveness of corrective actions through self-assessments. It also incorporates many important aspects of the LANL issues management process, such as determination of significance, requirements for root cause analysis, and assignment of root cause coding, as defined in LIR 307-01-05 and its accompanying LIG.

Considering the large number of LCAPs that need to be reviewed, CARB reviews of organizational LCAPs have been prioritized based on risk factors, including facility operations and hazards and the number and significance of resumption issues. At the time of this Independent Oversight inspection, the CARB was in the process of completing its review of the first three corrective action plans for the Los Alamos Neutron Scattering Science Center; the Manufacturing Systems and Methods Division; and the Computing, Communications, and Networking Division. These were used as "beta tests" for the process. Three separate CARB review teams have also been established and are currently engaged in reviewing other high-priority corrective action plans developed by LANL's divisions, including C and DX Divisions.

The initial CARB reviews of organization LCAPs have been rigorous and in some instances have identified a significant number of deficiencies in LCAP analysis, actions, and milestones. For example, the CARB's preliminary review of C-Division's LCAP identified many weaknesses in the adequacy of significance-level assignments, evaluation of causal analysis and cause code assignment, timeliness of corrective actions for issues (e.g., some issues were not planned to be closed for several years), effectiveness of corrective actions, and accuracy of information entered into the tracking system. Independent Oversight's work observations and review of the C-Division LCAP reaffirmed CARB's observations. In addition, Independent Oversight's work observations revealed a number of persistent deficiencies (e.g., lack of participation of subject matter experts in work planning, which had been identified during pre-start and had been closed through compensatory measures) at the facility/activity level. (See Findings #1, #2, #3, and #13.)

Furthermore, for all three LANL organizations reviewed by Independent Oversight in this inspection (C-Division, NMT, and DX), a large number of resumption findings and significant observations had been binned into a very small set of broad issues, and corrective actions were directed at addressing the rollup issues rather than the individual resumption findings. For these divisions, there is insufficient evidence that corrective actions for the broad issues will fully address the specific MSA findings. Furthermore, these divisions have not yet formally defined verification/validation processes for determining the effectiveness of corrective actions. (See Finding #13.)

The weaknesses in the line organization LCAPs and verification processes highlight the importance of rigorous implementation of the CARB process to ensure that identified deficiencies are effectively addressed. Without a strong review process, the weaknesses in LCAPs and the LANL MSA process (see Section D.2.2) could significantly reduce the value of the extensive management self-assessment effort.

D.2.2 LANL Feedback and Improvement Systems

As discussed in Section D.2.1, LANL has implemented a number of specific processes to track and manage the numerous issues (e.g., findings) and corrective actions resulting from the resumption effort. This section addresses LANL's established feedback and improvement processes that are used for non-resumption issues.

Background on Previous Deficiencies

LANL safety feedback and improvement processes and performance were rated Needs Improvement by Independent Oversight in April 2002. That Independent Oversight inspection determined that although many feedback and improvement mechanisms were being used at LANL, these mechanisms, particularly self-assessments and issues management, lacked institutional ownership and had not been fully developed or rigorously implemented to identify and effectively resolve integrated safety management (ISM) program and performance deficiencies and drive continuous improvement. That inspection also concluded that these systems lacked sufficient direction and management accountability, that issues management requirements were not well defined at any level, and that the numerous corrective action tracking systems had not been effective. The 2002 Independent Oversight report cited that institutional ownership and responsibility for these management systems was being assigned to a newly established performance assurance division.

During the 2004 work suspension, all LANL organizations performed MSAs, which included a number of assessment criteria related to feedback and improvement processes and performance. The MSAs conducted by the organizations addressed by the current Independent Oversight inspection all identified deficiencies in the areas of self-assessment, issues management, employee safety concerns, and lessons learned. Specific institutional feedback and improvement issues had been identified through these MSAs or were included in the institutional issues being addressed through the corrective actions developed by the operational efficiency projects. At the time of this Independent Oversight inspection, revisions to the processes for management assessments, issues management, and lessons learned were also under development by the new Performance Surety Division. An Independent Oversight team that conducted a special assistance review during resumption efforts made recommendations to LASO related to LANL activities, including the application of lessons learned during the MSA and resumption process to the development and implementation of the CAS and revised feedback and improvement processes. These recommended lessons included techniques for verifying that requirements are fully understood and correctly implemented at the working level, divisional/group management accountability for performing assessments enforced by senior management, rigorous management review of the quality and comprehensiveness of line self-assessments, and identification of deficiencies through proactive assessments rather than reacting to events.

Contractor Assurance System

In April 2005, LANL issued a CAS description document that described fiscal year (FY) 2004 as a year of improvement, implementation, and integration of the CAS; FY 2005 as laying a firm foundation of performance; and FY 2006 as exercising a sustainable assurance system model. The LANL assurance model is described as based on a foundation of management self-assessment, complemented by functional, process, and independent assessments and performance indicators. The model also considers LASO and other external oversight activities and is driven by the objectives and measures defined in Appendix F of the DOE-University of California contract. The LANL CAS model also describes the improvement element through application of the issues management model as defined in the LIR document overseen and managed by the IAB and the Executive Board. The CAS description document also details the LANL accountability model, which describes roles and responsibilities for positions from the Laboratory Director to workers.

LANL recently completed the FY 2005 baseline assessment of their CAS and issued a draft report in October 2005. This draft report identified a number of strengths and opportunities for improvement. While providing much useful information concerning stakeholder perceptions of CAS implementation, the draft baseline assessment could provide more useful feedback to management. The primary bases used to evaluate the CAS were various previous LANL self-assessments and a number of surveys of LANL senior management and LASO and National Nuclear Security Administration (NNSA) customers. The methodology should also consider incorporating more direct evaluation of the adequacy of the processes and implementation products of CAS elements in the field, in accordance with a risk based sampling plan. In addition, the report would be more useful with a better description of the measurement plan and measures used, including the number and significance of overdue corrective actions and a quantitative comparison of externally and internally identified findings. Further, the maturity of CAS elements needs to be determined by a judicious combination of methods to include performance based observation and analysis and sufficient analysis of data.

Assessments

LANL has established processes for identifying and conducting internal independent and line management self-assessments, including less formal, but documented management safety walk-around (MSWA) assessment activities. Top-level policy documents, called laboratory performance requirements (LPRs), detail performance criteria and requirements for conducting independent and line management self-assessments of work activities and the effectiveness of facility operations. The Assessments group in the Audits and Assessments Division performs independent assessments of an appropriately prioritized selection of institutional safety programs and their implementation. Seven independent assessments, led by qualified and certified team leaders, were performed in FY 2005, and nine are scheduled for FY 2006. Independent assessment reports reviewed by the Independent Oversight team consistently reflected good planning, appropriate scope and rigor, good documentation, and well-crafted and meaningful findings, observations, and recommendations. Findings are directly input to I-Track and tracked to closure by the Audits and Assessments Division. (However, see discussion in the issues management section below for weaknesses in the assignment of ownership for independent assessment findings.) The Assessments group also conducts special reviews when requested by LANL organizations. Independent Oversight's review of four of these special reviews indicated that the reports identified a variety of issues and recommendations but none were identified as findings and none were input to I-Track. Although the LANL internal independent assessments were appropriate and of high quality, the requirements and processes for implementing the LPR requirements and identifying, planning, and conducting internal independent assessments and reviews are not defined in any institutional or organizational procedures.

LANL has also established and implemented a formal process for identifying and scheduling MSAs. An LIR details the requirements for conducting self-assessment activities, comprising assessments by line management and by functional managers. An internal website provides additional guidance about management expectations for self-assessments, including such tools as sample criteria review and approach documents and templates for assessment plans and reports. The line management assessment portion of the LIR was superseded by a Director's Instruction issued in March 2005 pending revision of the LIR. This Director's Instruction details the processes for conducting line management assessments by division, center, office, and program leaders, including the issuance of an annual (fiscal year) assessment plan, a risk-based schedule and frequency, and structured reports submitted to directorate managers and the Performance Surety organization for trending and analysis. The Director's Instruction specifies an assessment frequency based on facility hazard categorizations, with radiological, nuclear, and moderate- and high-hazard non-nuclear facilities reporting quarterly and all other facilities reporting semi-annually. The Instruction specifies that the first assessment period would be the six months ending September 30, 2005, and that all facilities were to issue reports for this first period. C-Division and FMD developed formal assessment plans and conducted assessments, and at the time of the Independent Oversight inspection they were drafting summary self-assessment reports. In addition, FMD developed a comprehensive management assessment program manual and implementing management assessment procedure. However, the NMT and DX Divisions, two organizations evaluated by Independent Oversight that have numerous high- and moderate-hazard facilities/activities, have not identified, planned, or performed MSAs as required by the Director's Instruction. In addition, the ten designated Functional Managers—individuals appointed by the Laboratory Director to be responsible for coordinating, monitoring, and assessing implementation of program areas such as fire protection, occupational safety and health, safety basis, quality, and environmental management—have not performed the LIR-specified program assessments since the spring of 2004.

LANL has also established and implemented a formal process, detailed in an LIR, for performing less-formal assessments of working conditions and performance through a program of MSWAs, conducted by managers from deputy group and office leaders up through the Laboratory Director. The LIR appropriately specifies that walk-arounds are to focus on the performance of specific safety activities, including contractor and tenant activities, and are intended to identify safety deficiencies and workplace problems as well as noteworthy practices. The LIR also establishes sets of general and specific requirements for the conduct of MSWAs, including documentation of the walk-around details and results in a central LANL database with disposition and tracking of corrective actions. A graded approach to establishing the frequency of walk-arounds is specified, with a minimum expectation of three per quarter for managers with low-risk operations, such as office environments, and a higher number expected for managers with higher-risk operations. An internal website provides additional guidance regarding the MSWA process and management expectations, including 15 detailed functional area guidance cards (checklists). Computer-based training on walk-around techniques and expectations is available for managers and supervisors. During the past year, LANL has instituted a commercial, supervisory, behavior-based observation program that is being integrated into the MSWA program. This structured program involves six training sessions for supervisors and managers in observation and feedback techniques and has changed the format and content of MSWA reporting. Many supervisors and managers have been trained in this new process. The Performance Surety Division provides oversight of the MSWA program, and the performance of MSWAs by each directorate and division is posted quarterly in the *LANL Mirror*, a widely distributed and read publication of incidents, actions, and lessons learned at the Laboratory. Many MSWAs are being performed and documented, with an overall Laboratory-wide level of performance of 87 percent, relative to the minimum specified three MSWAs per quarter, for the April-June quarter. C-Division and FMD essentially met or exceeded expectations for the past two quarters. However, their reported level of performance is based on the low expectations for "office environment" operations, and several organizations in the Independent Oversight inspection sample with significantly higher-risk operations were not achieving even this low level of compliance. For example, in the last two quarters, only 90 and 81 percent of NMT Division managers met the three-per-quarter MSWA criterion, and in DX division only 68 and 89 percent of managers met this criterion over these periods. Only C-Division had developed the MSWA plan as required by the LIR; DX, NMT, and FMD had not.

The Independent Oversight team reviewed a sample of over 150 MSWA reports from 2005. Some of these were well documented and reflected managers' interaction with workers, review of work planning documents, and evaluation of conditions and worker performance. However, many of the reports lacked rigor in the substance and quality of documentation of the scope of the evaluation, did not reflect observation of work or interaction with workers, did not identify assessment criteria as specified in the LIR, and did not document many database fields correctly or at all. Further, the database is intended to provide a tool for identifying deficiencies or issues that are not corrected on the spot, documenting corrective actions and owners, and tracking actions to closure; however, none of the sample reports reviewed by Independent Oversight used this tool, although a number of them identified issues that required longer-term or follow-up actions. A review of over 100 behavior-based safety system MSWA reports identified significant improvement in documentation content and in identifying corrective actions and status, which are now tracked on the same reporting ticket. However, the actions taken or to be taken, action status, and basis for closure are often still not clearly documented.

The LANL organizations that were reviewed during this Independent Oversight assessment had identified self-assessments as a deficient area during their 2004 work suspension MSAs and are addressing those deficiencies to various degrees in their LCAPs. However, none of these deficiencies has resulted in formally documented or tracked interim actions, and the LCAP actions address only long-term activities, such as developing division-level assessment procedures; the target completion dates extend many months into the future. C-Division and FMD have established the organizational infrastructure for the self-assessment function, have assigned personnel to implement it, and have developed appropriate procedures. Although personnel have been designated with collateral duties related to self-assessment in the NMT and DX Divisions, the organizational structure and definition of roles and responsibilities are not as mature. DX has no internal procedure to further define how self-assessment activities are to be conducted. NMT has an administrative procedure, which is being revised to address the Director's Instruction requirements, but it has not been implemented since the 2004 work suspension.

Significant deficiencies were also identified in the LANL self-assessment program by an internal independent assessment report issued in July 2004, which resulted in self-identification of a Price-Anderson Amendments Act (PAAA) violation (PAAA-NTS-LANL-2004-0018), *Institutional Management Assessment Program*. Concerns about inadequacies in the LANL self-assessment program were also discussed in a DOE Office of Price-Anderson Enforcement Preliminary Notice of Violation and Proposed Civil Penalty issued in June 2004. Corrective actions for the Noncompliance Tracking System report and part of LANL's transition to a new suite of site policy documents, which will replace LIRs, Director's Instructions, and other policy and procedure documents, included development and issuance of a new implementation procedure (Operational Assurance Program Procedure), describing operational assurance (e.g., feedback and improvement) elements. Another Noncompliance Tracking System report corrective action specified issuance of detailed procedures describing each of these processes, including both independent and management self-assessments, called implementation support documents. These new documents have been under development for over one year, and the due dates have been extended twice (currently scheduled for completion by November 30, 2005). However, the Laboratory Director stated in a presentation to all LANL personnel in August 2005 that no new policies or internal requirements would be issued and that no more internal audits or assessments would be performed. These directions or statements of intention have not yet been more formally documented or communicated for implementation, and there is some confusion about management expectations. However, management personnel interviewed by the Independent Oversight team indicated that this policy constituted a moratorium on the issuance of these new and improved feedback and improvement policy and procedure documents. No end date for this moratorium has been identified, and it appears that closure of the PAAA violation action items will be further delayed.

The maintenance services subcontractor, KSL, has established a formal self-assessment program governed by a recently issued (June 2005) procedure. However, the management assessment procedure lacks sufficient requirements and action steps to identify the scope and schedule of self-assessments, KSL managers had developed no plans or schedules, and only two self-assessments had been performed at the time of this Independent Oversight inspection.

The 2002 Independent Oversight inspection at LANL identified deficiencies in the rigor of self-assessment activities, including management walk-arounds, and identified that institutional requirements and directions had not ensured consistently effective implementation of assessment programs. Similar deficiencies were identified by LANL's independent assessment and by the organizational self-assessments in 2004. Corrective actions have been neither timely nor effective, and implementation of existing processes and interim actions have not been enforced; those same deficiencies persist today. Further, the failure of several major divisions to implement the current requirements to plan and conduct MSAs and their failure to conduct functional manager program assessments reflects a reduction in the level of self-assessment activity at LANL and a continuing lack of management accountability for compliance with requirements. The current senior management edict regarding suspension of issuing new policies and requirements could further delay establishment and implementation of an effective self-assessment program at LANL.

Finding #12. LANL has not established and implemented a fully effective management self-assessment program that ensures that safety programs and performance are routinely and formally evaluated.

Corrective Action and Issues Management

The following discussion focuses on LANL processes and performance for managing non-resumption-related issues; the evaluation of resumption issues management is discussed in Section D.2.1.

Issues management and corrective action requirements for non-resumption issues are currently defined in an LIR issued in June 2003 as supplemented by an August 2004 LIG. I-Track is the designated action tracking tool, although various other systems are used at LANL to track issues and actions. I-Track contains numerous separate modules or domains, including one for each division and for resumption issues, safety committees, PAAA issues, and the Occurrence Reporting and Processing System (ORPS). The same platform is used to document safety concerns, MSWAs, and incident reports. Several LANL organizations have recently instituted new mechanisms to improve the quality and rigor applied to managing safety issues. FMD and NMT have formed boards of SMEs and managers to review issues and proposed corrective actions, ensure appropriate levels of analysis, and support effective resolution of issues affecting the division. The LANL divisions examined during this Independent Oversight inspection have assigned issues management coordinators, and the Performance Surety Division has provided training on the planned new action tracking tool. KSL has issued a process improvement management procedure describing its issues management program.

A new institutional support document has been drafted and a new commercial action tracking tool has been acquired, but they are not yet approved for use and their issuance has been delayed by senior management (as discussed above).

Inadequacies in LANL corrective action and issues management processes and performance have been identified by external and internal assessments repeatedly and are acknowledged to be problematic by LASO and LANL management. The 2002 Independent Oversight inspection report identified numerous weaknesses in LANL's corrective action and issues management processes and performance, including the failure to document many issues in I-Track, ineffective and untimely resolutions, and inadequate guidance and tools for analysis, trending, and tracking. LANL developed and implemented six corrective actions in response to the feedback and improvement finding detailed in the 2002 Independent Oversight report; the actions included clarifying roles and responsibilities, conducting focus-group studies of issues management and assessment processes, and revising procedures for these management systems. These actions have been ineffective, because these weaknesses in processes and performance continue to impede effective and continuous safety improvement at LANL. A comprehensive and rigorous assessment of the LANL issues management processes by Performance Surety in late 2004 identified serious disconnects in the issues management processes. Identified deficiencies included insufficient rigor in characterizing safety problems, poor causal analysis, insufficient accountability for actions, multiple and non-integrated tracking tools, and inadequacies in trending and identification of institutional issues resulting in ineffective improvements in work planning and execution. The report provided recommendations for short- and long-term corrective actions. However, LANL management did not take formal, focused actions to address these deficiencies or recommendations.

Although many issues are documented in I-Track and other tracking systems, a review of I-Track data shows that it is not being used consistently to formally document and manage the resolution of issues, and that issues that are input to I-Track are not always adequately addressed or resolved in a timely manner. Root cause analyses are not always performed for issues categorized as high significance, as required by procedure. Trending analysis and metric reporting requirements required by procedure are not being performed and reported to senior management. Many issues dating back to 2003 remain open. I-Track remains an awkward, non-user-friendly system that does not support data retrieval for trending and analysis and effective reporting of performance to management. Causal analysis and extent-of-condition determinations are rarely performed. There are no institutional or division-level policies or procedures detailing the requirements or processes for trending or causal analysis. The existing requirements document is out of date and does not have sufficient detail or high expectations for management of safety issues. Line organizations have not established formal issues management implementing processes as required by the LIR.

Underlying these continuing performance problems in issues management at LANL are several common areas of weakness. These include insufficient detail and requirements in policy/procedure documents, insufficient understanding of issues management purposes and processes by LANL employees, and the failure of line management to ensure that an effective program is established and fully implemented.

The significance categorization definitions and thresholds in the LIR for issues management are set in a way that results in few issues being subjected to causal analysis or validation of effectiveness. Further, the definitions and classification thresholds for issues lack sufficient detail, examples, and guidance. The current LIR requires root cause analysis and effectiveness validation only for issues categorized as high significance, which is defined as a "severe potential risk that poses imminent hazards." Issues categorized as medium and low significance require only an apparent-cause code assignment, with no documentation of the basis for the apparent-cause determination and no effectiveness review. The LIR does not specify who makes the significance determination. The Independent Oversight review of internal independent assessment findings indicated conservative categorization, but line organization categorizations and resumption issue categorization are less conservative. For example, none of the post-restart issues from NMT, DX, and C Divisions' resumption self-assessment and readiness reviews were categorized because they first binned these issues into rollup issues and did not put the original findings into the I-Track database. Subsequently, C-Division then classified all of their common issues as "low" significance, and DX and NMT divisions categorized all of their rollup issues as "medium" significance. As a result, none of these major, crosscutting, divisional/directorate common management issues have had, or require by procedure, a root cause analysis or reviews to validate effectiveness. The current LIR does not require or address the determination of extent of condition as part of the analysis and action plan development process.

Several examples reflect inadequate implementation of the issues management program through inappropriate and untimely responses to identified safety issues. Issues from the May 2005 internal independent assessment report on IWM implementation have not been managed effectively or in compliance with the LANL issues management LIR. Two findings, categorized as high significance, described work not being adequately defined, hazards not identified, controls not implemented, and IWM responsibilities not being performed for some work activities in many LANL organizations. However, as of October 20, 2005, over five months after the report was issued, no root cause analysis had been performed, no interim actions or compensatory measures had been documented, and no corrective actions plan had been established in I-Track. A third finding, categorized as medium significance, stated that qualified-worker activities were not qualified as required by procedure, and personnel performing hazard identification and analysis were not required to be trained. This issue was improperly closed in I-Track by indicating that the issue is addressed by the operational efficiency training and qualification initiative, an activity that is not timely (with action completion target dates extending out many years). In addition, the three corrective actions from the operational efficiency project on training were cited as addressing this issue but were clearly not timely (target completion date in April 2006) or were unfunded for at least the current fiscal year. No interim actions or compensatory measures were established to prevent continuing non-compliance and to ensure that workers doing hazardous work activities are sufficiently trained as required by the new integrated work management procedure, IMP-300.2. Further, none of these actions address the adequacy of the processes and role of the IWMC in approving qualified-worker determinations. As a result of Independent Oversight's preliminary observations, this issue was reopened in I-Track, and KSL management placed a formal work suspension on moderate-hazard qualified-worker task planning and field execution until a corrective action plan is developed.

C-Division has recently conducted some rigorous and comprehensive self-assessments, but the management of deficiencies identified during these assessments was not sufficiently timely and rigorous. Although the assessors communicated concerns to group leaders, "Persons in Charge" (PICs), and affected individuals, some significant safety deficiencies identified during laser safety assessments were not promptly documented, screened, and managed as required by the LANL issues management process. The response to some of these identified issues again illustrates an insufficient sense of urgency to promptly document deficiencies and conduct evaluations for needed immediate or interim actions. These deficiencies included expired IWDs, deficient hazards analyses, incomplete training, non-conservative laser classification, inadequate protective devices and barriers, inadequate alignment procedures, inadequate eye protection for the type of laser, and inadequate communication. Some immediate actions were taken, and these deficiencies were appropriately documented on assessment reports, but no issues were recorded in I-Track at that time. In one case, the report stated "The PIC and Group Leader understand that laser operations are not to commence without another LSO walkthrough that results in a passing appraisal." However, no written directive or formal stop-work order was issued. Further, the assessment reports were submitted to the directorate operations support staff for inclusion in a division self-assessment report, with the joint expectation that issues requiring entry into I-Track would be identified during report preparation. These reports identified deficiencies in laser processes, conditions, performance, and assessment that call into question the effectiveness of the previous corrective actions. Considering the number and significance of the deficiencies and the attention focused on recent significant laser events at LANL and C-Division, such deficiencies warranted more timely and rigorous actions.

At the request of LASO, Performance Surety conducted a thorough analysis of LANL Post-Standdown Occurrence and Subthreshold Events in April 2005 and identified a number of short- and long-term recommended actions. This report concluded that LANL causal factor and corrective action profiles demanded attention to correct a decline in occurrence performance. The report also identified that the sub-threshold events (events below the ORPS reporting requirements) were not given the appropriate level of rigor in reporting and review. LASO and LANL management were briefed on the results of this analysis and provided with the completed report. However, the recommendations have not been reviewed against ongoing initiatives or evaluated for needed actions that should be documented and tracked in I-Track. Further, LANL has not established sufficient institutional- or division-level processes to support the requirements of DOE Order 231.1A and DOE Manual 231.1-2 for tracking and trending incidents that do not meet the criteria for reporting to DOE. LANL does not include non-reportable data in the periodic analyses of events for trends and repetitive occurrences as required by DOE Manual 231.1, and the institutional event-reporting procedure does not specify inclusion of this data in the required trend analysis and reporting.

Issues identified by internal independent assessments are not addressed holistically to identify actions to address line and support organization implementation deficiencies as well as programmatic, process, and oversight deficiencies. In internal independent assessment reports, the Audits and Assessments Division assigns ownership of complex findings that involve failures to adequately implement LANL requirements to program owners with recommended corrective actions and puts these issues directly into I-Track. Separately, memoranda are sent to the individual line and support organizations that were evaluated, describing the good practices and deficiencies identified during the assessment. However, issues identified in these memoranda have not been put into I-Track by Audits and Assessments. Program owners, who accept the responsibility for addressing the assigned issues, develop corrective action plans that address only the programmatic elements of the issues; line and support organizations do not take documented actions to address implementation issues. For example, a July 2004 internal independent assessment of the management assessment program identified five findings, with five associated action recommendations for the division's process owners. All actions established by Performance Surety were assigned to Performance Surety. The many cases of inadequate implementation of the program and LANL requirements documents that were cited in the report and communicated to C, DX, and NMT Divisions were not put into I-Track or otherwise formally addressed by the line organizations. Audits and Assessments does not follow up on line actions until the next examination of that topical area. The line performance deficiencies identified in the May 2005 internal assessment of IWM implementation were handled in the same manner; line organizations did not initiate I-Track issues and were not held accountable for failure to follow LANL procedures by either the Audits and Assessments independent assessment process or the program owners. The existing issues management LIR and LIG do not adequately describe the process for addressing issues with multi-organizational responsibilities (i.e., the assignment of ownership of issues and actions).

As discussed in Appendix C, corrective actions for many of the deficiencies identified in the 2002 Independent Oversight inspection, other external assessments, or the MSAs have not been implemented, have not been timely, or have not been effective. In addition, care must be taken to thoroughly analyze and document the lessons learned from the difficulties in implementing the new IWM procedure and apply them to the planning for the transition to a new issues management process and action tracking tool.

Finding #13. LANL has not established and implemented a fully effective corrective action program that ensures that safety deficiencies are appropriately documented, rigorously categorized, and evaluated in a timely manner, with accurate identification of root causes, extent of condition, and appropriate recurrence controls.

Injury and Illness Investigation and Prevention

Injury and illness statistics for recordable and lost workday rates at LANL exceed NNSA and all DOE rates for the last four quarters and have been on an increasing trend since 2000. Occupational injury and illness case rates are key lagging indicators in the LANL performance indicator program and are monitored and reported quarterly to senior management and LASO. The July 2005 "stoplight" chart for these key performance indicators reflected unsatisfactory performance ratings for 29 of 41 LANL organizations and marginal performance ratings for five more organizations. LASO ratings of LANL performance in this area for the first two quarters of FY 2005 were unsatisfactory; after significantly raising the goals and rating thresholds, LASO rated performance for the third quarter of FY 2005 as satisfactory.

The LANL General Employee Training and the Occupational Medicine (HSR-2) internal website specify that workers, including subcontractors, are to report occupational injuries, illnesses, and toxic exposures to their supervisors and go to the occupational medicine clinic during normal hours or the nearest care facility after hours. Notice 139, *Notification and ISM-Based Investigation of Safety Events at LANL*, issued in April 2004, delegates the investigation and determination of causes and any corrective/preventive actions incidents that do not meet ORPS reporting thresholds to "responsible managers" and investigation of some Category 2 and Category 3, 4, and R ORPS reportable events to the responsible division leader and Performance Surety, and the investigation of Category 1 and some Category 2 ORPS-reportable events to teams led by associate directors. Notice 139 requires investigation and documentation of non-ORPS-reportable work-related injuries or illnesses and exposures to hazardous chemicals or physical agents and documentation in the LANL MSWA database.

For ORPS-reportable events resulting in injuries, the investigation and analysis of causes and documentation are generally rigorous and well documented. Monthly meetings on recordable cases with occupational medical and Computerized Accident/Incident Reporting System (CAIRS) staff in the Health, Safety and Radiation Protection Division (HSR) to review each new case, follow up on ongoing cases, and evaluate restricted/days away cases. Various actions to improve occupational injury and illness rates have been taken at LANL, including conducting numerous ergonomic investigations, taking preventive actions where indicated, implementing a number of safety communication programs (including safety committees), and initiating behavior-based safety observations programs.

LANL has not managed the unacceptable case rates and adverse trends as a significant safety issue. LANL and LASO have repeatedly acknowledged that performance with respect to recordable and days away/restricted case rates and trends are unacceptable; however, this issue has not been subjected to any rigorous, comprehensive causal analysis. No management assessments or internal independent assessments of the occupational injury and illness program have been performed by line or support organizations. While a variety of corrective/preventive actions have been initiated or enhanced at the institutional, directorate, or division levels, these actions have not been managed in a prioritized, comprehensive, and coordinated manner with project controls and management review and support.

The Independent Oversight team identified numerous deficiencies in processes and performance for the investigation and performance improvement of occupational injuries and illnesses:

- Programs and processes are inadequately defined in institutional and divisional procedures. There are no institutional or divisional procedures describing the requirements and processes for occupational medicine or CAIRS reporting processes. Notice 139 contains no linkage to CAIRS reporting, is unclear on requirements for documentation of corrective/preventive actions, contains no linkage to the LANL issues management program or the PAAA program, and acknowledges "localized data systems" for recording events in addition to the use of the MSWA system. There is no requirement or guidance for the involvement of safety and health professionals in the investigation or determination of causes and needed actions.

- Although several HSR groups and line managers have a variety of responsibilities for managing occupational injury and illness incidents, these activities are not formally considered as a program or functional area and no organizational/functional owners have been established to monitor and administer these activities effectively.

- HSR performs no quality check of input from line management (e.g., the adequacy of event descriptions, and causes and actions) on the DOE injury and illness investigation forms that are reported to CAIRS.

- The MSWA database is not routinely used to document the investigation of injuries and illnesses as required by Notice 139. Approximately 40 incident reports in the MSWA database from October 1, 2004, through September 19, 2005, were related to injuries/exposures (including KSL workers). However, approximately 120 first aid and recordable injuries and exposures were reported during this period by C, DX, and NMT Divisions.

- The majority of the DOE injury and illness investigation forms are sent to CAIRS without completion of the fields describing the activity/events, causes, or actions by line management. Independent Oversight selected and reviewed 38 investigation forms documenting injuries and exposures in C, DX, and NMT Divisions for 2004 and 2005, including eight Occupational Safety and Health Administration (OSHA) recordable cases and 30 first aid (non-reportable) cases. Of these 38 reports, only 4 of the OSHA recordables had complete activity/event descriptions, causes, and action fields, and none of the non-recordable cases had these fields completed. Further, for 9 of the 38 cases, HSR sent reminders to responsible line managers citing the expectation to investigate the injury and develop corrective actions, but only 2 managers subsequently submitted the required information.

- KSL occupational injury and illness investigation processes are inadequately detailed in administrative procedures and contain a number of conflicts and inconsistencies. The requirements for KSL to implement their investigation and reporting process for ORPS-reportable KSL injury events where investigations are managed by LANL (supported by KSL) are not clearly detailed in procedures. The Independent Oversight team reviewed several recent case files and identified instances where the evaluations of causes and descriptions of events were inadequately documented and corrective actions were not put in the KSL module of LANL's I-Track as required by procedure. In most cases, no causes or actions were documented in required DOE forms.

- In one case, involving a pipefitter experiencing dizziness as a result of exposure to fumes while brazing in a confined space, the investigation and follow-up were inadequate. No DOE form was on file. The initial incident report, completed by a KSL safety professional, identified problems in the work planning, improper placement of the air monitor pickup in the worker's breathing zone, and the failure of the worker to wear a harness and rope for emergency retrieval. No further evaluation or corrective/preventive actions were documented or on file, including the actions taken to complete this job. Independent Oversight reviewed the IWD and confined space permit and determined that the permit failed to identify the potential for toxic gases or fumes as either a primary or secondary hazard, the ventilation specified as a control on the IWD was not supplied, and the required chest or full-body harness for emergency rescue was not in place. KSL did not identify the causes and document the preventive actions taken to address these deficiencies. (See Appendix C for additional discussion of deficiencies in IWDs and air monitoring on confined space permits.) During this inspection, KSL management initiated a formal review of all injury and illness investigation processes and procedures and began development of a strategy for consolidating procedures and strengthening investigation and corrective action processes.

Overall, poor occupational injury performance has been inadequately investigated and addressed by LANL and KSL management. Formal processes are deficient, line management investigations and corrective/preventive actions have been inadequately performed or documented, and line management is not held accountable for compliance with LANL and DOE requirements.

Finding #14. The LANL injury and illness program lacks sufficient rigor to ensure that incidents are consistently reported to supervision and sufficiently documented, that root causes are identified, and that effective corrective and preventive actions are identified, documented, and implemented.

Lessons Learned

The requirement to develop and communicate lessons learned from operating experiences from within and outside LANL for application to work planning and performance is identified in the LANL Performance Requirements document for Performance Assurance. No implementing processes have been issued, but guidance on lessons-learned notifications and feedback is contained in an Operations Support Tool document issued in 2003. The lessons-learned program is coordinated by an individual in the Feedback and Improvement Team of the Operational Assurance Group in the Performance Surety Division. Three group procedures describe the processes for receiving and processing lessons learned information, producing and distributing alerts, and disseminating information (e.g., the *LANL Mirror* publication). The primary lessons-learned process at LANL is for the coordinator to screen external lessons and internal event notifications, seek evaluation of potentially significant and applicable lessons from functional area managers, and coordinate dissemination of lessons learned resulting from this review process. An internal lessons-learned website provides a searchable database of LANL lessons learned, links to the DOE Headquarters database and other DOE site databases, an organizational lessons-learned contact list, forms for submitting lessons learned, and links to current and archived editions of the *LANL Mirror*. The *Mirror* is a professional quality publication, issued quarterly, that summarizes in approximately 30 pages LANL reportable occurrences, selected DOE complex events, various lessons learned, management walk-around performance, and ORPS report corrective action status. Lessons learned published in the *Mirror* and early-notification lessons-learned alerts, called "First Takes," are well written and supported by photographs or graphics. The *Mirror* is available on line and is widely distributed in hard copy at various locations on site. Various laboratory, directorate, and division-level documents reviewed by the Independent Oversight team indicate that lessons learned are being communicated to organizations and workers and discussed at safety meetings. The NMT Division has issued an internal administrative procedure that details the processes for sharing and applying lessons learned in the division from events that do not meet ORPS reporting thresholds, as well as externally generated lessons learned. The procedure includes instructions for conducting lessons-learned meetings and inquiries, documenting and disseminating lessons learned, and tracking any resulting corrective actions. Lessons learned are generated and disseminated to NMT personnel, and any needed actions are documented and tracked to closure.

Although lessons learned are being reviewed, generated in a high-quality manner, and disseminated to the workforce, the existing processes and application are still informal and there is insufficient evidence to demonstrate that lessons learned are effectively applied to work at LANL. Few lessons learned are being posted to the LANL website. Although LANL typically experiences more than 100 ORPS reports from LANL events annually and many more operational, injury, or exposure incidents below ORPS reporting thresholds, only eight lessons learned have been posted to the database to date in calendar year (CY) 2005 and only 11 were posted in CY 2004. Important lessons learned, such as the DOE Office of Environment, Safety and Health special reports on hoisting and rigging and electrical safety, were not posted or specifically evaluated for applicability and action or communicated to site personnel.

A new institutional support document has been drafted that strengthens and details the processes and requirements for implementing and managing the LANL lessons-learned program. However, as discussed above, recent senior management actions could delay the issuance of the enhanced procedures on feedback and improvement program elements, such as lessons learned.

Employee Concerns Program

LANL has established and implemented a formal process for employees, contractors, and visitors to voice and obtain evaluation and resolution of environment, safety, and health (ES&H) concerns. An internal safety systems website contains a database and links to the LANL safety concerns program, including a descriptive overview, instructions for filing a concern, and frequently asked questions. Where anonymity is not desired, concerns can be posted on line. Persons desiring anonymity can call a telephone "hotline" number published in the "frequently asked questions" section of the website. An LIR for the safety concerns program was issued in 1998. However, the LIR has not been maintained to reflect organizational and process changes and inadequately addresses such issues as the maintenance of confidentiality, linkage to alternate concerns resolution, appeals processes (such as DOE safety concerns programs), or any linkage to the LANL issues management process for deficiencies that should receive more structured analysis and management.

This system is actively used by LANL workers, with over 170 concerns logged in CY 2004 and over 130 to date in CY 2005. A review of the concerns database indicates that most safety concerns have been closed within a few days to a month. However, a few took many months to close, and five concerns initiated in CY 2004 remain unresolved. Six concerns from CY 2005 have remained open for over three months, and several have been open for over nine months. In one case, a significant issue should have been addressed using the LANL issues management process. In January 2005, a worker reported that on three different occasions, maintenance personnel disabled power to a laboratory hood exhaust without notification and without restoring power to the hood exhaust motors. The issue was closed with statements indicating incorporation of a requirement into the KSL work package to interface with facility managers before and after work activities on those specific units. The root causes and extent of condition for these potentially significant performance deficiencies were not documented, and it is not clear that the action taken provided sufficient recurrence control.

Other Feedback and Improvement Processes

LANL uses other means to communicate feedback and initiate improvements in safety programs and performance, including behavior-based safety observation programs and safety committees.

LANL has established several safety behavior work observation programs that provide real-time feedback on safety performance; improve communication of expectations and concerns among workers, supervisors, and management; and have led to improvements in safety programs. The behavior-based safety observation program for supervisors discussed above is scheduled to be expanded to the general workforce at LANL in FY 2006. NMT has a mature (initiated in 2000) behavior-based safety observation program called ATOMICs, and has conducted between 50 and 250 observations a month over the past two years. In July 2005 (the latest month with compiled data), over 250 people were observed during 177 observations, and over 100 at-risk behaviors were identified and corrected.

Another institutional program providing for the communication of feedback between workers and management and initiation of improvement actions is the "nested" safety committee program. This program involves a pyramid of interconnected committees from the team level in all organizations, through group, division, and directorate-level committees, to the Director. Committees, chaired by senior managers, are expected to meet monthly and review safety performance metrics, injuries and other safety incidents, MSWA issues, work process problems, and similar issues. Subcommittees of each committee research and analyze various data and issues brought to the committee to provide analysis and recommendations for resolution. Issues that are not resolvable by a specific committee are communicated to higher-level committees for disposition.

This safety committee concept and structure has been in place at LANL for many years, but implementation and effectiveness have varied over time, depending on consistent and widespread participation by all organizations and management levels. This feedback and improvement mechanism suffers from a lack of formally defined implementation requirements, including responsibilities and sufficient accountability mechanisms. After revival in early 2004, the purposes and processes have undergone additional recent reviews by site management. A new charter for the top-level Director's Central Safety and Security Committee was issued on August 23, 2005. There are several dated publications and references to the nested safety committee concept, some documents at the division level address safety committees, and the role of this safety committee structure is credited in the LANL ISM system description. However, there are no institutional policy or procedure documents that detail the requirements and expectations for this program. Although several organizations, including the HSR and NMT Divisions, have tracking systems for issues identified by nested safety committees, there are very few issues in the safety committee domain of I-Track.

D.3 Conclusions

The operational efficiency project, the CARB, and LCAPs are important initiatives that are contributing to LANL efforts to manage resumption issues, improve ES&H programs, and enhance safety performance. Each of these initiatives has a number of positive aspects, such as the detailed CARB processes, and a number of accomplishments have resulted, such as LANL's conduct of operations manual. However, deficiencies were observed in all three of these initiatives. LANL management is not adequately addressing the factors that reduce the effectiveness of the operational efficiency project, such as the lack of institutional drivers and shortcomings in the verification/validation process. Additionally, the CARB has not yet made substantial progress on reviewing the numerous LCAPs and institutional issues and action plans. The LCAPs also need sustained management attention at the institutional and division levels to address weaknesses in implementation of corrective actions, including establishment of clear and timely milestones and an effective process for validating the effectiveness of the actions in addressing the original issues.

LANL has issued a CAS description document and has established and implemented a variety of fundamental feedback and improvement processes. Significant resources and efforts have been directed at cataloging, analyzing, and developing corrective action plans for the issues identified during the 2004 resumption MSAs. However, progress in developing and implementing the resulting corrective actions has been slow, interim or compensatory actions have not been identified, and in some cases LANL organizations have failed to maintain compliance with existing feedback and improvement process requirements. Institutional roles and responsibilities for feedback and improvement programs have been better defined, and process oversight has been assigned to a new Performance Surety Division. However, authorities for ensuring effective implementation of these programs are less clearly understood or exercised, and LANL management has not held organizations and managers accountable for effective implementation. In general, although safety problems are being identified and addressed and progress is being made in addressing known safety program issues, minimal improvement has been made in most feedback and improvement processes, and performance since the Independent Oversight inspection in 2002 has degraded in the area of management assessment. Significant revisions in feedback and improvement requirements and process documents have been drafted and a new issues management tracking tool has been acquired, but LANL management has suspended the issuance of new requirements documents pending selection of the successful bidder for the new prime contract (scheduled for December 2005). Delays in the development and issuance of these improved institutional management system documents adversely affect continuous improvement in safety performance at LANL.

D.4 Rating

Core Function #5 – Feedback and Continuous Improvement - SIGNIFICANT WEAKNESS

D.5 Opportunities for Improvement

This Independent Oversight inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

1. **Address institutional and directorate/divisional management weaknesses that delay resolution of previously identified deficiencies in feedback and improvement systems and/or impede the effective establishment and implementation of sound feedback and improvement programs at LANL.** Specific actions to consider include:

   - Prioritize the completion, approval, and issuance of the operational assurance process and the supporting institutional support document for independent and management assessment, issues management, lessons learned, trend analysis, and abnormal events programs and processes.

   - Formally assess the methodologies used to develop and deploy the new IWM process and the resulting deficiencies and weaknesses in process documents and implementation, identify lessons learned from this project, and ensure that lessons learned are applied to the development and deployment of new feedback and improvement processes.

   - Ensure that sufficient ES&H resources (e.g., technical and administrative personnel and funding) are allocated in each directorate and division to effectively support ongoing feedback and improvement programs. Ensure that clear roles, responsibilities, and authorities are established.

   - Establish formal implementation manuals and procedures at the directorate and division levels for feedback and improvement programs that promote and ensure consistency and compliance with institutional programs and processes.

   - Ensure that management at all organizational levels clearly and formally communicates to all personnel their full support of and expectations for full compliance and effective implementation of feedback and improvement processes and programs. Empower program and process owners to provide rigorous monitoring and oversight of program implementation.

   - Integrate into institutional, directorate, and divisional feedback and improvement processes sufficient reporting and management decision mechanisms that routinely bring to management's attention meaningful measures of the level of implementation and performance in feedback and improvement processes. Provide for escalation of responses to performance problems to trigger effective corrective measures.

   - Establish mechanisms to ensure the continuity and sustainability of corrective actions addressing MSA issues during changes in management and through the transition period for the new contract, contractor organization, and personnel.

2. **Significantly strengthen processes and efforts to identify and eliminate the causes of occupational injuries, illnesses, and exposures.** Specific actions to consider include:

   - Manage an injury and illness performance improvement initiative with an empowered, multi-organizational task force supported by appropriate SMEs and advisors.

   - Establish an organizational/functional owner to provide coordination and oversight of the processes involved in addressing all aspects of responses to occupational injuries and illnesses.

   - Establish formal institutional processes and procedures for all aspects of injury and illness response, reporting, and case management. Clearly and formally define roles, responsibilities, and authorities for all responsible organizations and personnel.

   - Conduct a formal root cause analysis or analyses on occupational injuries, illnesses, and exposures.

   - Develop a comprehensive corrective action plan or plans based on the causal analysis/analyses that aggressively addresses contributing and root causes and contains periodic performance based assessments and progress evaluations to validate actions and implementation.

- Implement the action plan(s) in accordance with project management techniques and tools.

3. **Significantly strengthen processes and efforts to manage resumption issues.** Specific actions to consider include:

   - Ensure that operational efficiency project milestones include mechanisms that drive line management implementation and independent verification/validation of effectiveness.

   - Re-establish a clear chain of responsibility and accountability for corrective actions that extends from the institutional to the division, facility, and activity levels.

   - Ensure that authority and resources invested in the operational efficiency project are commensurate with senior management expectations for this project.

   - Strengthen the scorecard process in formality and execution.

   - Ensure that CARB reviews of consolidated MSA/LRR issues (i.e., those in broad sets of bins) fully evaluate the corrective actions for the full range of issues that were binned.

   - Ensure that institutional standards and guidance drive verification/validation processes for determining the effectiveness of corrective actions.

APPENDIX E
ESSENTIAL SYSTEM FUNCTIONALITY

E.1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight (Independent Oversight) evaluated essential system functionality (ESF) for selected safety systems at the Los Alamos National Laboratory (LANL) Technical Area (TA)-55 PF-4 facility. The systems selected were the important-to-safety heating, ventilation, and air conditioning (HVAC) systems and the fire suppression systems. Independent Oversight also evaluated the various programmatic functions associated with assuring that these and other safety systems are capable of performing their safety functions with a high level of confidence commensurate with their importance to safety, such as configuration management, the unreviewed safety question (USQ) program, maintenance, and operations.

Independent Oversight also evaluated LANL's role in the safety system oversight (SSO) program, including corrective action management, as applied to previous and newly-identified deficiencies with the selected systems , as discussed in Appendix F. The review of SSO included the LANL cognizant system engineer program and other LANL assessment systems, and includes information about corrective actions for TA-55 safety systems. The evaluation of the ESF elements in this Appendix also considers the SSO deficiencies identified in Appendix F.

The purpose of an ESF assessment is to evaluate the functionality and operability of selected structures, systems, and components (SSCs) that are essential to safe operation of the facility. The review criteria are similar to the criteria for the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2000-2 implementation plan reviews; however, the Independent Oversight reviews also include technical evaluations of the selected SSCs' design, engineering, configuration management, operation, maintenance, surveillance, and testing. Additionally, these reviews address a facility's authorization bases (ABs) and related programs, such as the USQ program. ESF assessments are performed at a very detailed technical level that includes system calculations that are the bases for the systems' designs and safety analyses; the documented safety analyses (DSAs) and other related AB documents, such as technical safety requirements (TSRs) and the fire hazards analysis (FHA); drawings; specifications; vendor documents; facility-specific technical procedures; facility walkdowns; and interviews with system engineers, design engineers, maintenance and testing engineers, operators, technical managers, and other technical support personnel. The primary focus of these reviews is verification that the systems' designs and ABs are technically correct, consistent, and in accordance with applicable codes, standards, regulations, and DOE orders, and that the systems are fully capable of performing their design safety functions.

E.2 Results

E.2.1 Engineering Design and Authorization Basis

The overall designs of most aspects of the PF-4 HVAC and fire suppression systems are generally adequate. In the HVAC systems, the fans, dampers, ductwork, appurtenances, and control systems are of robust construction and provide the redundancy, layout, etc., that generally ensure logical, manageable operations, reliability, and ease of maintenance and testing for most normal operations. The control settings for the cascading building and glovebox pressures are appropriate for normal operational contamination control while still allowing safe, convenient access to working spaces. Likewise, the fire suppression systems are of robust design and construction in most regards. For example, redundant water sources powered by diverse power sources provide high source reliability. Additionally, the fire suppression systems provide the added safety of defense-in-depth that is not credited in the accident exposure analyses.

Weaknesses were identified in the engineering design and/or the supporting analyses for the PF-4 important-to-safety HVAC and fire suppression systems, the technical validity and completeness of the 1996 ABs, and the translation of design, analyses, and ABs into the facility's procedures and practices. These weaknesses reduce the assurance that these systems can perform their safety functions. In most cases, weaknesses in supporting programs, such as configuration management and SSO, contributed to the identified engineering design and AB weaknesses. (Also see Appendix F).

Design and Analysis Weaknesses

Weaknesses in engineering design and analyses include:

- **Failure of safety-class ductwork due to fire.** The 2002 FHA analyses indicate that the safety-class HVAC ductwork could experience temperatures of 500° F or higher, which is an increase from the original 200° F design temperature. There are no documented analyses that address the ductwork's integrity at the higher temperature, considering the thermal stresses that could result from this increase. Loss of ductwork integrity could allow bypass leakage in excess of accident analysis assumptions.

- **Failure of Zone 1 header due to fire and its impact on the Zone 1 high-efficiency particulate air (HEPA) filters.** The 2002 FHA did not adequately analyze the effects of a room fire on Zone 1 HEPA filters. Although it predicted room temperatures in excess of 800 – 1000° F for at least 100 minutes, it provided no analysis of the integrity of the Zone 1 header when exposed to these temperatures. Further, this header is classified only as safety significant; thus, it cannot be credited to protect the safety-class Zone 1 HEPA filters. Thermally induced failure of this header would result in the hot room gases being drawn into the Zone 1 HEPA filter plenums. Cooler diluting air flow from the other gloveboxes would be relatively low due to their relatively high flow resistance compared to a breached header's resistance. Thus it is possible that the resultant temperature could be significantly higher than the new HEPA filter limit of 500° F. An additional concern is the effect of oil located in the glovebox bubblers, which regulates pressure in the individual gloveboxes. The 1999 FHA analysis of Zone 1 HEPA filters for the glovebox fire predicted temperatures of 1600 – 1800° F for 10 minutes. However, these analyses predicted increase of the exhaust plenum temperature by only 10° F because they credited the cooling dilution flow from the other unaffected gloveboxes (about 50). This analysis did not take into consideration the temperature effects on the oil-filled glovebox bubbler, which could include vaporization of the oil and subsequent fire in the ductwork, and the potential effects of such a fire on adjacent gloveboxes and the HEPA filters (including soot loading). The 2002 FHA analyses also did not address the effect of a room fire on the oil bubblers for all gloveboxes located in the room and the consequent effects of this oil on Zone 1 HEPA filter loading and the potential for fire in the ducts.

- **Non-conservative final safety analysis report (FSAR) analyses for the design basis seismic event.** Both the current (1996) and draft updated (2002) FSAR analyses of the design basis seismic event are based on the assumption that all ventilation systems' fans cease to operate as a result of the event. However, there are no safety-class, seismically qualified design features or procedures to ensure that all fans would actually shut down. Consequently, there are other credible individual fan and equipment failure scenarios that are not considered in the FSAR that could produce public exposures in excess of the currently calculated value (18 Rem) and the 25 Rem evaluation guidelines. A failure modes and effects analysis was not developed to provide a systematic review of all credible scenarios The following are several such failure scenarios identified during this assessment (others may exist):

  - **Failure of all fans except one or more supply fans.** Continued operation of one or more supply fans would pressurize the facility with respect to the outside, causing forced, high-volume, unfiltered, ground-level release from the building. Any fans in operation, for this scenario or any other involving fan operation, would tend to maintain the material at risk and dust generated in an airborne state longer than the current FSAR scenario and therefore more subject to release.

  - **Failure of the Zone 2 recirculation fans only.** Much of the dust generated by the event would be drawn into the bleed-off filter trains, along with the combustion products from the design basis seismically-induced fire. Failure of the recirculation fans would preclude the recirculation HEPA filters from removing most of this material. Instead, this material would collect on the bleed-off HEPA filter and could cause high differential pressure (dp) and possible subsequent failure; they are rated at only 10" water column (w.c.) dp, while the fans can generate almost 12" w.c. Their failure would also allow forced, high-volume, unfiltered release from the building, albeit at the stack level. Additionally, even if they did not fail, their loading could reduce bleed-off flow below the building supply flow, thereby pressurizing the building and causing forced, high-volume, unfiltered, ground-level release.

– **Failure of the non-seismically qualified, safety-significant Zone 1 ductwork between the gloveboxes and the exhaust header.** Seismic or Zone 2 fire-induced failures of this ductwork could provide open flow paths from the rooms to the Zone 1 exhaust HEPA filters, which also have not been analyzed for the dust and/or combustion product loading resulting from this event. These filters are also rated at only 10" w.c. dp, and the Zone 1 exhaust fans can generate approximately 15" w.c., which could cause these filters to fail as well, also causing forced, high-volume, unfiltered release from the building. Even without this failure consideration, the safety-significant ductwork is credited as defense-in-depth in the accident analysis; therefore, seismic support of this ductwork is required.

- **Inadequate temperature qualification for safety-class HEPA filters.** These filters could also experience 500° F temperatures for the design basis fire. The only currently available vendor documentation indicates that they are only qualified for the 300-325° F range. Additionally, the current FSAR incorrectly indicates a 200° F design temperature.

- **Inadequate TSR facility dp limits to account for wind effects.** Any wind will reduce the static pressure on most of the exposed outside building surfaces (roof, sides, and back relative to wind direction). Unless the TSR dp limits are lower than these wind-induced negative pressures, the resultant localized net differential pressures will be positive, potentially negating the building's confinement function. Although the FSAR discusses the wind effect, it asserts, without supporting analyses, that the wind effect is offset by increased dispersion of any resulting release. Although correct in principle, this discussion is inadequate; it does not address the relationship of wind speed to the degree of offset. Detailed analyses performed at other facilities indicate that the offsetting effects are not equalized until wind speeds reach between 20 and 25 miles per hour. Therefore, the FSAR analyses are non-conservative for most commonly occurring wind speeds.

- **Incorrect design of the two outside static air pressure probes, which provide input for control of the confinement HVAC systems.** These probes are located at the roof edges, a location that is not representative of the building geometry and where they are subject to upward wind drafts from building sides, thus introducing non-conservative errors. In addition, the design of the sensing probe heads also introduces non-conservative errors. Further, because they are not seismically designed, in a seismic event where the operating fans continue to operate, the probes may provide invalid sensing that could exacerbate releases.

- **Ambiguity in the FSAR and other AB documents regarding whether a tornado is a design basis event.** Although the FSAR has a lengthy discussion and analysis of a design basis tornado and extensive descriptions of the facility's design features and capabilities for this event, it also has statements that could be interpreted as indicating that a tornado is not a part of the design basis. The original design specifications for the HVAC systems listed a tornado as a design basis event and described design features to protect the safety systems, some of which are clearly in the actual design. However, no design features or analyses have been identified for the important-to-safety HVAC systems to demonstrate that they are protected from the rapid pressure drop produced by a tornado (1 psig in 2 seconds), which could collapse ductwork and cause HEPA filter structural failure.

- **Lack of seismic support for fire suppression piping above lab ceilings.** As a safety-significant system required as defense-in-depth in the accident analysis, seismic support of sprinkler piping is required. This is a longstanding, recognized deficiency that has not been adequately addressed.

- **Insufficient fire suppression water pressure in some laboratory areas to meet the spray density requirements of Ordinary Hazard Group 2.** The insufficient water pressure was confirmed by calculations in 2001, but no corrective actions have been taken. A potentially inadequate safety analysis (PISA) and positive unreviewed safety question determination (USQD) assessed the non-conforming condition related to five sprinkler heads in Room 105. Although the National Nuclear Security Administration (NNSA) concluded that there were no imminent safety concerns and that no curtailment or reduction in operations was warranted, NNSA recommended compensatory actions, including modifications. Subsequent calculations in 2002 used a 10 percent degraded pump curve consistent with DOE-STD 1066, *Fire Protection Design Criteria*, which states that hydraulically designed sprinkler systems should be designed for a supply pressure of at least 10 percent but not less than 10 psi below the supply curve. The subsequent calculations revealed additional heads in other rooms with insufficient pressure/flow. Reclassifying the facility (or portions) as Ordinary Hazard Group 1, and thereby reducing the pressure/flow requirements has been considered; however, there have been no actions to date.

- **Possible vulnerability of the diesel-driven fire pump exhaust to external events.** The diesel exhaust silencer and piping that penetrate the pump room roof have a vertical cantilevered configuration, without a protective enclosure. Calculation C49912-CLC-C15, Rev 2, which was performed as part of the TA-55 Fire Protection Yard Main Replacement Project, was reviewed along with associated calculation C49912-CLC-S02. The purpose of these calculations was to confirm that the fire protection delivery system is capable of supplying fire water following a design basis earthquake. Although most piping within the pump house was evaluated for seismic adequacy, the diesel exhaust piping penetrating the roof to the silencer was not. Additionally, other external event load cases were apparently not considered. For example, the diesel exhaust silencer and piping may be exposed to high winds and/or tornado effects with no protection from missiles. Wind and/or missile impacts could crimp or deform the piping and stall or degrade pump performance. Additionally, high winds could cause exhaust backpressure sufficient to degrade engine performance or possibly stall the engine. National Fire Protection Association (NFPA) 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, states "The exhaust pipe and muffler, if used, shall be suitable for the use intended, and the exhaust back pressure shall not exceed the engine manufacturer's recommendations." LANL does not have any analysis that considers high wind load cases.

Authorization Basis Weaknesses

Weaknesses in the authorization bases include:

- The following design concerns, which are described in more detail above, entail incorrect or ambiguous information in the current FSAR, TSRs, or other AB documents**:**
  - **Non-conservative HVAC ductwork and HEPA filter temperatures for a design basis fire.** The current FSAR states that the temperature will not exceed 200° F.
  - **Selective failures of HVAC components in a design basis seismic event, which could produce public exposures in excess of current analyses and evaluation guidelines.** Current analyses address only failure of all fans.
  - **Wind effects on building differential pressures and hence confinement.** The current FSAR incorrectly dismisses this effect as insignificant, without supporting analysis.
  - **The design basis tornado.** The FSAR is ambiguous as to whether this is a design basis.

- The Zone 2 bleed-off fan configurations are non-conservative with respect to their FSAR descriptions. The FSAR describes three bleed-off fans: one normally operating, one in standby (which automatically starts upon loss of the operating fan), and a third installed spare to allow maintenance on one of the other fans without entering a limiting condition of operation. LANL does not have documentary evidence of the operability of the third fan.

- The current AB-described design basis wind velocity for the straight-line wind event is ambiguous. The FSAR describes it as 93 mph; Appendix B of the TSRs describes it as 117 mph.

- TSR 5.6.5 describes three fundamental criteria from 10 CFR 830 that define a USQ. The third criterion is described incorrectly. It states that a USQ exists if a margin of safety "as defined in the bases of the TSRs" could be reduced. This phrase was taken from DOE Order 5480.21, which was superseded by 10 CFR 830, which removed this phrase to make this criterion more broadly applicable.

- The TSR 5.5 list of programmatic actions to be addressed before any temporary change may be made to TSR surveillance procedures is missing the requirement for entering the USQ process.

- The annual fire pump performance test is not a TSR requirement, although it is tested as part of the integrated work management (IWM) process. Additionally, no acceptance criterion is provided in the IWM test procedure. The fire pumps are safety-significant and are required as defense-in-depth in the accident analysis; therefore, consistent with DOE-STD-3009, the TSRs should include a surveillance requirement for their performance testing.

Weaknesses in Flowdown to Facility Procedures and Practices

In a number of cases, the design, analysis, and AB parameters do not flow down into facility procedures and practices. Specific weaknesses include:

- **Non-conservative, vague, and unanalyzed combustible-control criteria**. In response to DNFSB concerns about the accident analysis leak path factor being applied to the design basis fire in the FSAR, LANL proposed interim TSRs that incorporated controls to limit combustible materials in PF-4. These controls were based on the 2002 FHA and were reflected in the proposed 2002 updated FSAR. A July 28, 2005, Los Alamos Site Office (LASO) memorandum to LANL, Subject: Approval of Interim Technical Safety Requirements for the TA-55 Facility, approved the continued operation of TA-55 before approval of the upgraded FSAR and TSRs based, in part, on "the increased safety controls related to the Combustible Control Program." These controls were intended to be implemented through three TSR surveillance procedures: TA55-TSR-005-R04, *Transient Combustible Control Inspection;* TA55-TSR-AP-010, R03.1, *Transient Combustible Control Inspection for Designated Gloveboxes;* and TA55-TSR-AP-012, R00, *Combustible Loading Control Inspection for Pu238 Laboratories*. The limits in these TSRs should also have flowed down into integrated work documents (IWDs). Contrary to this, these procedures and documents did not conservatively reflect the combustible-control criteria of the design and authorization bases. On November 8, 2005, LASO and TA-55 agreed to revise the combustible-control surveillance as delineated below and include defensible control criteria by January 15, 2006:

  - Procedure TA55-TSR-005-R04, *Transient Combustible Control Inspection*, has the following deficiencies:

    - Item 9.6.3 non conservatively determined that "combustible materials stored inside gloveboxes, or enclosed in metal containers such as … filing cabinets, metal desks ... are not considered Transient Combustibles." This provision allows transient combustible storage in non-Underwriters Laboratory (UL)-listed containers and the placement of large quantities of flammable liquids inside gloveboxes (see additional details below in discussion of TA55-TSR-AP-010, R03.1, *Transient Combustible Control Inspection for Designated Gloveboxes*).

    - Attachment A allows storage of 15 trash storage boxes in one of the rooms. Based on an FHA equation, the 15-box limit may be non-conservative.

    - Although the 2002 FHA, Section 2.5.3, established explicit room limits on ethanol in non-UL-listed containers based on the room geometry "to prevent a hot gas layer from reaching 500° C," the procedure stated no ethanol storage limits.

– Procedure TA55-TSR-AP-012, R00, *Combustible Loading Control Inspection for Pu238 Laboratories*, has established a criterion to prevent transient combustibles within 3 feet of polymethyl methacrylate in designated laboratories. The acceptance criterion of 3 feet is not conservative with respect to the requirement in the FHA Section 2.5.2 of 1.5 meters (4.9 feet).

– Procedure TA55-TSR-AP-010, R03.1, *Transient Combustible Control Inspection for Designated Gloveboxes*, has no defensible combustible control crieria on ethanol or any other flammable liquids inside gloveboxes. Its acceptance criterion is vague (i.e., either SAT or UNSAT). The only stated limits are expert-based and related to quantities "needed for day-to-day operations." The limits are too vague to be enforceable or clear to operators. Defensible, technically based criteria should be established and surveyed for adherence. The Independent Oversight team, in an attempt to better understand the quantities that might be present, reviewed procedure PHA LA-CP-1998-0162, *Process Hazards Analysis, Sample Preparation and Characterization At TA-55*, for a room addressed by this procedure. This procedure allowed up to 2 liters of ethanol per glovebox in 12 gloveboxes (24 liters total in the room), with no UL restrictions on the containers. However, the Independent Oversight team's evaluation, using the FHA analysis approach, limited the ethanol in this room to only 12.2 liters. Using the same criterion, the limit for a conservatively large glovebox should have been less than 200 cc. Independent Oversight team members observed ethanol being used in a glovebox with no limits for its use in the IWD, and the technician performing the work was not aware of any limits. The FHA states in Section 8.2.2 that "The quantities of combustible materials within and in proximity to the gloveboxes are too low for a fire to spread beyond the glovebox." However, based on Independent Oversight's observations, this conclusion is not substantiated in the actual facility operations.

LA UR 99 2677, *Mechanistic Analysis of Glovebox Fire Propagation*, is referenced in the 2002 FHA as the analysis of the consequences of a glovebox fire. The Independent Oversight team noted a number of concerns about this document: It contains no supporting analysis and thus lacks the details required to understand its conclusions. Specifically, the assumptions for the baseline fire are potentially non conservative. Although it states that in evaluation of combustible materials "in addition to ordinary combustibles (such as Kimwipes and other cellulose trash), fires involving flammable liquids (solvents) and pyrophoric metals were examined," the documented baseline fire used only "ordinary combustible materials." Further, the assumptions for the fuel burn rate were "a fire … ignites in a single glovebox 60 s into the calculation. The heat-release rate from the fire increases linearly from 0 to100 kW over the next 60 s, then remains constant for the duration of the simulation (subject to availably of adequate oxygen)." These assumptions appeared to be highly non-conservative compared to the assumptions regarding a methanol fire in the basement described in the 2002 FHA, App B-1383 (LA-UR-02-1383), p. 14, Figure 3. The heat release rate in this calculation of about 22,000 kW (reached in less than 5 seconds) is substantially higher, and this analysis was for methanol, which has a calorific value less than the ethanol stored in the gloveboxes (23kJ/g versus 30kJ/g, respectively). The team's concern is further exacerbated by the fact that ethanol is extremely flammable; with a flash point at 12° C, it has a very low lower-flammability limit (3 percent), and an auto-ignition temperature of 363° C. The combination of these factors raises a concern that a glovebox fire in the presence of large quantities of ethanol in non-UL containers could lead to an air-fuel explosion. Neither the LA UR 99 2677 document nor the 2002 FHA addresses this issue.

- **Loss of safety-class confinement boundary control.** During a ventilation system walkdown in PF-4, it was identified that several bypass valves on a number of safety-class Zone 1 and Zone 2 HEPA filter plenums were incorrectly in the open position. The open valves could invalidate the results of HEPA filter TSR surveillances. LANL issued a PISA and performed a USQD to address this condition. It was determined that the incorrectly positioned bypass valves did not introduce enough error in the HEPA filter efficiency calculations to invalidate the previous tests. However, the discovery was determined to be a positive USQ because the open valve allowed a flow path that bypassed the second stage of HEPA filters credited in the accident analysis.

- **Potential bypass leakage from the idle trains into the filter outlet plenums of the trains being tested not addressed in the TSR surveillance test procedures for the Zone 2 bleed-off HEPA filter efficiency.** The parallel filter trains are linked at the outlet plenums by a cross-connect header with isolation dampers that do not provide positive shutoff. This linkage may allow dilution of the outlet concentration of the test medium, thereby non-conservatively skewing test results.

- **Potential for contamination release and spread not addressed in the Zone 2 recirculation and bleed-off HEPA filter changeout procedures.**

- **Substantial errors in the table of flow orifice differential pressures versus flows provided in the building confinement doors' TSR surveillance procedure.** Although inaccurate, the errors are conservative.

- **Lack of ventilation system component position lists/tables, such as valve lineup lists, and lack of TSR requirements for periodic verification of the positions/states of ventilation components.**

- **No requirement to "chock" wheels of carts carrying potentially hazardous materials, such as liquid nitrogen tanks, in TA-55.** Twelve such tanks on un-chocked carts were observed near a nitrogen feeding station, one unattended and attached to the feed station. All of the tanks had copper tube fittings extensions attached, which protruded outside the safety collar. These extensions typically consist of an isolation valve connected to the tank and a device downstream of the isolation valve. Interaction between these fittings and the objects outside the safety collar could impact the integrity of the tank's pressure boundary (i.e., the connection between the isolation valve and the tank).

- **Inadequacy of the new procedure TA55-TSR-AP-030, Rev 00, *Heat Loading Log for Temporary Storage of Pu238*.** Although not directly related to the systems targeted by this assessment, this procedure was reviewed as a part of the USQ process review in a sample of USQDs. The procedure's stated purpose was "to VERIFY, in a general sense, the overall conservatisms in the predictions of the thermal calculations [for Pu238-contaminated wastes stored in drums] by comparing against the predictions relative to external drum surface temperatures." The Independent Oversight team identified the following questions/concerns:

  – The procedure requires that the drum skin temperature be monitored twice a day, but it gives no monitoring intervals. The readings could be taken at any time intervals and with any interval variation. This does not appear consistent with the procedure's intent.

  – The procedure does not specify where on the drums to take the readings. If they are not taken at the same place each time, they may produce widely varying values that are not comparable. For example, even if it is assumed that the plutonium-238 distribution is uniform within the drum (which is not likely) and the waste material uniformly contacts the drums' inner surfaces (also not likely), there could be wide variations between the temperature of a drum's top, bottom, and sides.

  – The procedure requires that only one temperature reading be taken at a time. As noted, because there is no assurance of uniform distribution and contact with the drum interior, there is the potential for non-uniform temperature distribution on the outside of a drum; therefore, one reading taken at any time would not be representative of the drum's temperature.

– Because the procedure does not specify the location in the facility or the environmental conditions under which the readings are to be taken, one could conclude that the procedure is valid for use at any location and under any environmental conditions. Such a conclusion is not valid; for any given drum with an internal heat load, the measured temperature could vary widely, depending on the environmental conditions (e.g., air temperature, wind velocity, ventilation conditions, wet or dry, in the sun or in the shade).

– The procedure does not specify how or where the ambient temperature, which is the basis for comparison, is to be measured. Again, depending on the particular environmental conditions of the location where the measurement is taken, this could vary widely.

This procedure thus appears to be so lacking in specifics for taking temperature measurements as to render any such measurements unreliable for the procedure's purpose.

- **Annual diesel-driven fire pump test data not corrected to account for engine speed**. The annual pump performance testing includes measuring and recording pump discharge pressures at various predetermined flowrates to create a current pump curve. This curve is then used to establish and quantify the magnitude of pump degradation from the original manufacturer's baseline test curve. Flow data collected during the annual test was measured at engine speeds in excess of the nominal 1750 rpm acceptance curve speed and was not normalized using pump affinity laws. As a result, the pump test reports do not accurately reflect the degree of pump degradation; in reality, more degradation exists than was documented. For example, data collected from the last PF-11 diesel pump test and documented in the test report concluded that at rated flow of 1000 gpm the pump exhibited a discharge pressure of 4 psi greater than the baseline acceptance curve. In reality, however, when normalized for engine speed, the pump exhibited a discharge pressure 3½ psi lower than the acceptance curve. Furthermore, at 1500 gpm, the test report concluded that the discharge pressure was 2 psi below the acceptance curve, while normalized data reveals 7½ psi below acceptance, which results in greater than 5 percent degradation. For degradation in excess of 5 percent, NFPA 25 requires an investigation to reveal the cause of degraded performance. Additionally, although not evaluated in detail, data obtained for the TA-35 fire pump test revealed a similar evaluation approach, and greater degradation exists for these pumps as well.

Finding #15. Technical deficiencies in the designs of the LANL PF-4 important-to-safety HVAC and fire protection systems, in their authorization bases, and in the translation of these designs into facility procedures and practices significantly compromise or call into question these systems' ability to fully perform their safety functions.

Summary

The overall designs of *most* aspects of the PF-4 HVAC and fire suppression systems are generally adequate. However, significant discrepancies or voids in the designs and analyses of both systems could prevent or degrade the performance of their full design-basis safety functions. Likewise, significant discrepancies or voids in the authorization bases for these systems and in the translation of their design and authorization bases into facility procedures and practices render them, or could render them, non-conservative with respect to requirements.

E.2.2 Configuration Management

Several aspects of configuration management are weak, including system configuration documentation, control of system lineups, document control, maintenance of the safety basis (FSAR), and execution of the USQ program (including the PISA process). Most of the deficiencies in these areas were contributing causes of, or were closely associated with, the engineering design weaknesses described above. Specific weaknesses in these areas are described below.

System Configuration Documentation Weaknesses

Several facets of system configuration documentation were weak, including the absence of numbering and identification of important-to-safety components; poor identification and compilation of equipment vendor documentation; and poor generation and maintenance of current system design documents, such as drawings, specifications, and other design documents (e.g., calculations). For example, LANL did not have documents to demonstrate:

- Environmental qualification for the HEPA filters at 500° F
- HEPA filter loading calculations for the design basis seismic event and fire
- Bases calculations for the TSR building dp limits
- Outside building static pressure probe design drawings
- Diesel fire pump exhaust stack seismic and wind qualification calculations
- Up-to-date piping and instrumentation drawings for the HVAC and fire protection systems.

System Lineup Control Weaknesses

The ability to effectively control safety system lineups for normal day-to-day operations, testing, maintenance, etc., is severely hindered by the general absence of assigned component identification numbers; incomplete, incorrect, and out-of-date system drawings; the absence of component identification tags and markings; and the absence of equipment lineup and status lists in plant technical procedures. For example, the HEPA filter bypass dampers were found to be incorrectly open.

Document Control Weaknesses

A fundamental element of configuration management is document control, which includes processes, organizational elements, and facilities for identifying, indexing, cataloging, storing, marking, retrieving, duplicating, and issuing all facility technical documentation. At PF-4, a document control system has been established for facility procedures but is not comprehensive (e.g., virtually no design-related documentation is controlled by this system). As a result, much of the facility's technical documentation, particularly engineering and design documentation, has not been adequately controlled. Much of this engineering documentation is stored in uncataloged personal files or in uncontrolled boxes in the basement, or it is not retrievable. Many of the documentation requests made by the Independent Oversight team could not be filled or required extraordinary measures and effort to provide, and the facility staff related similar experiences in meeting their own day-to-day needs. The system configuration documentation weaknesses listed above are examples of such document control weaknesses.

Safety Basis Maintenance Weaknesses

The current safety basis for this facility is the 1996 FSAR. A 2002 general FSAR revision is currently being generated by LANL and reviewed and approved by LASO.

The 1996 FSAR has not been kept current, as required by regulation until it is superseded. The FSAR and other AB documentation have not been updated when new information regarding the facility was discovered, when the facility and its procedures were changed, and when errors, omissions, discrepancies, and inadequacies were discovered in the current approved FSAR. In addition, the USQ process, including the PISA process, has not always been entered in a timely manner, as required by 10 CFR 830.

In a number of cases (as described in the previous sections), facility staff had previously become aware of AB shortcomings and failed to take the appropriate corrective and safety basis maintenance actions. For example, no action was taken to address:

- Increase of the design basis fire temperature for the HVAC systems from 200° F to 500° F
- Laboratory areas with insufficient fire suppression water pressure to meet the spray density requirements for Ordinary Hazard Group 2
- Non-conservative Zone 2 bleed-off fan configurations with respect to their FSAR descriptions.

There were also a number of instances where technical concerns were identified for the first time during this assessment, and LANL staff did not enter the PISA process in a timely manner. Conditions included:

- Non-conservative FSAR analyses of equipment failures for the design basis seismic event

- Inadequate analyses of important-to-safety HEPA filter loading for the design basis seismic and Zone 2 fire events

- Inadequate TSR dp limits to account for the wind effects

- Ambiguity as to whether a tornado is a design basis event for the facility

- Non-conservative design of the outside static air pressure probes, which provide input for control of confinement HVAC systems

- Loss of safety-class confinement boundary control with the discovery of open bypass valves on a number of safety-class Zone 1 and Zone 2 HEPA filter plenums.

Other inadequacies previously identified by LANL and LASO were addressed in the *Interim Technical Surveillance Requirements*, which were issued in June 2005 and superseded the original TSRs.

Finding #16. Fundamental elements of configuration management, such as accurate documentation of system configurations, control of system lineups, control of design documentation, and control of the current safety basis, are significantly deficient in LANL TA-55.

Unreviewed Safety Question Program (Including PISA)

The Independent Oversight team reviewed the execution of the USQ process in TA-55, including the conformance of the procedure (common for all LANL facilities) with the requirements of 10 CFR 830 and the guidelines of DOE Guide 424.1-1, and the quality and conformance of a sampling of USQ screenings and determinations with the procedure. Weaknesses were identified in the USQ procedure, screenings, and determinations.

Generally, the USQ procedure was clear, concise, and in most respects in conformance with the requirements of 10 CFR 830 and the DOE USQ guide. However, the following weaknesses were identified:

- The procedure had not been signed by anyone but the LASO Senior Authorization Basis Manager; no LANL person signed in the cover sheet preparer, reviewer, or concurrence boxes.

- In Section 8.3, the second paragraph, which discusses the types of activities that may not be eliminated by the screening process, does not include PISAs, although required by 10 CFR 830.

- In the discussion of the USQD question, "Is this a temporary or permanent change in the procedures as described in the existing documented safety analysis?", the first paragraph on page 25 implies that unless such procedures are required by the TSRs or are for safety SSCs, changes to them are not required to be considered. This is not correct; changes to all procedures related to SSCs described or implied in the DSA are required to undergo the USQD process, regardless of their safety classification or TSR requirements. One of the screening samples used this incorrect rationale to screen out a facility change.

- In Section 8.4, the seventh USQD question is "Does the proposed change reduce the margin of safety?" This wording is non-conservative with respect to 10 CFR 830, which uses the word "Could…" where the procedure question uses "Does…" and "…a…" where the procedure question uses the word "…the…" This error is also carried over into the USQD form, question seven.

The performance of the organization in screening activities to determine whether USQDs were required was very poor. Of 13 recent USQ screenings sampled, 12 did not comply with procedure requirements, and as a result, the required USQDs were not performed. As discussed in the following paragraphs, three cases were particularly egregious, because they were screened out by reference to a generic USQD in a practice that was tantamount to making an unauthorized, non-conservative change to the USQ procedure.

The USQ procedure properly contains a provision allowing activities to be screened out if they are evaluated to be of a type that is categorically excluded from requiring USQDs. However, in accordance with the procedure, all such "Categorical Exclusions" are part of the USQ procedure and must be approved by NNSA. To date, NNSA has approved none. The procedure also contains a provision allowing activities to be screened out if "the matter being considered is *fully* [emphasis added] covered by a previous USQD."

The Independent Oversight Team identified one example where TA-55 used this second provision to create, in effect, a generic Categorical Exclusion not approved by NNSA, in violation of the procedure. This interpretation allowed changes to certain types of technical procedures, which involved equipment described in the FSAR (including important-to-safety equipment), to be improperly screened out, in violation of 10 CFR 830. The example involved USQD-TA-55-04-084, which generically addressed new working-level implementation documents and procedures used in TA-55, and their revisions. It concluded that such changes did not involve a USQ if they remained within the confines of any governing preliminary hazards analysis (PHA) and the TA-55 DSA, and if they did not involve a six-item list of change types, which did not include working-level implementation documents and procedures.

By reference to this USQD, subsequent new working-level implementation documents and procedures and their changes could be screened out simply by an unsupported assertion by the originator that the change was within the confines of governing PHAs and the DSA. The particulars of how each such subsequent change was enveloped by the existing PHA and the DSA would not be discussed, because the USQD would not be performed. But addressing and documenting the technical particulars of individual changes with regard to the seven USQD questions is the process mandated by 10 CFR 830 for determining whether the change is within the DSA and thus whether it involves a USQ or not, not simply by proclaiming that it is within the DSA; therefore, this practice effectively circumvents the intent of the procedure and 10 CFR 830, and is tantamount to changing the procedure by adding a non-conservative Categorical Exclusion not approved by DOE.

Three examples were identified where new IWDs that were subsequently screened out by reference to this USQD, and conversations with personnel involved with the program indicated that there were many more. These three IWDs addressed three separate technical subjects (TA-55-05-033 for leak testing in the down-draft room, TA-55-05-037 for disassembly of Build 11, and TA-55-05-099 for safe operation of helium leak detectors), and had in common only the fact that they were IWDs. Therefore, the matter being considered could not be "fully [technically] covered by a previous USQD."

Discussions with the PF-4 Safety Basis Office Leader revealed that audits by his office had identified three additional USQDs that had been incorrectly used in this same manner to screen out other generic change types. He also stated that in his office's recent "100 percent" audit of previous TA-55 USQDs, the facility had not provided the above-identified USQD. LANL has instituted corrective measures.

Finding #17. For TA-55, LANL has instituted an inappropriate practice of screening out generic change types involving SSCs described in the FSAR based on previous negative generic USQDs for those change types, thereby circumventing the screening and determination requirements of the USQ procedure and 10 CFR 830.

Other examples of USQ screening deficiencies include:

- Screening TA-55-05-154 addressed a site boundary change as a result of selling site land. This change was incorrectly deemed not to be a change to the facility as described in the FSAR, even though the FSAR explicitly discusses the offsite accident exposures in terms of the site boundaries. The screening rationale was that the changed boundary was farther out than the nearest site boundary. This rationale should have been in a USQD as a part of a discussion of change in consequences, not in the screening. Additionally, since a shorter distance to the receptor does not necessarily produce a higher exposure, as was implied by the discussion, this and other relevant factors, which were not discussed in the screening, should also have been discussed in a USQD.

- Screening TA-55-05-040 addressed replacement of a fire barrier door inside PF-4 with a non-exact replacement that was not formally evaluated for equivalency, and therefore constituted a change to the facility. The change was incorrectly screened out using the rationale that it was not a modification to a safety-class SSC. This was invalid, because a SSC's safety classification is not relevant to the correct screening criterion (is the proposed activity a change to the facility as described in the DSA?) This particular screening error was further propagated to a subsequent screening, TA-55-05-134, for the replacement of another fire door, which was screened out by reference to TA-55-05-040.

- Screening TA-55-05-046 addressed a new IWD to be generated to cover installation work for a previously generated modification to install a stainless steel, vacuum jacketed, liquid nitrogen supply line inside PF-4. Such a work document should address the interim conditions (i.e., temporary changes that would exist during the installation process). This document change was incorrectly screened out because the screening stated that the interim installation conditions were covered in the original modification package. However, this IWD did not exist at the time the USQD for the modification package was generated, so its detailed provisions could not have been reviewed by the previous USQD. Additionally, the discussions provided for the basic screening questions were for a different activity (eddy current testing).

- Screening TA-55-04-018 addressed a change to procedure NMT8-FMP-301-R00, "In-Place HEPA Filter Testing Qualification Card," to allow a six-month hiatus during which personnel who had not met the full requirements could perform these surveillances. Although the justifications and compensatory measures appeared reasonable, the change was screened out incorrectly based on the assertion that it was not a procedure change, when in fact it was a temporary change. Two subsequent screenings, TA-55-04-128 and TA-55-05-124, twice extended this expiration time by reference to the original screening, without a USQD.

- Screening TA-55-05-017 addressed a new procedure, NMT9-AP-029, R0, "Control of Material at Risk in the 238Pu Laboratories," which replaced HS-NMT9-PD-9, R03. The new procedure contained several technical changes from the old procedure, but the new procedure was screened out as not being a change to a procedure because "There are no changes to these operations performed in PF-4 as described in the existing DSA." This rationale implies that only procedural changes entailing a change in facility "operations" rate a "yes" answer, which is incorrect.

LANL is currently developing refresher training based on lessons learned from the USQ "back look" and the ongoing sampling process, and indicated that the examples above will be factored into that training.

Finding #18. USQ screenings at LANL TA-55 are not performed in accordance with the requirements of the site USQ procedure and 10 CFR 830, so that most changes do not undergo the required USQ evaluations.

The performance of the organization in executing USQDs was generally adequate. Fourteen of the fifteen negative USQDs that were reviewed reached appropriate conclusions and were adequately justified. In the one exception (USQD TA-55-05-146, which dealt with installation of an inert gas manifold for five bottles in Room 333 of PF-4 in place of the single-bottle installation), LANL did not sufficiently address whether the consequences of an accident or malfunction respectively be increased as a result of a change.

Summary

Most aspects of configuration management at PF-4 are inadequate, including system configuration documentation, control of system lineups, document control, and maintenance of the safety basis. These weaknesses have been significant contributing factors to weaknesses in facility design and safety analyses, as exemplified in most of the technical discrepancies that were identified in previous sections. The execution of the USQ process, including the PISA process, was also found to be inadequate with regard to actual screening of proposed activities, timely entrance into the PISA process, and the practice of using generic USQDs for changes in various technical activity types, involving SSCs described in the FSAR, as the basis for screening out other changes of those types; this practice circumvents the requirements of 10 CFR 830 and the USQ procedure.

E.2.3 Surveillance and Testing

10 CFR 830 requires that surveillances and tests be defined in the TSRs. The TSRs must ensure that safety SSCs and their support systems required for safe operation are maintained, that the facility is operated within safety limits, and that limiting control settings and limiting conditions for operations are met.

PF-4 has established a rigorous control system for scheduling surveillance and testing processes. As part of this system, the Operations Center carefully maintains a controlled set of TSR procedures that are used to generate the working copies for surveillance performance. The procedure controls have ensured that only the latest version of the TSR procedure is used. The TSR procedures were written to the requirements of the TA-55 procedures writer's guide and, as a result, are generally well written and adequately implement the conduct of operations requirements for good procedures. The surveillance and testing process appropriately includes formal training documentation for the surveillance performers on the list of TSR surveillances. Before starting surveillances, training documentation is verified to ensure that surveillance performers are qualified.

Following completion of TSR surveillances, the Operations Center operator reviews the results and documents, by signature, satisfactory completion. The completion date and next due date are updated in the surveillance tracking database. The TSR surveillance due dates are closely tracked, and several large video displays in the Operations Center provide ready access to this information. Color codes are used to highlight the highest priority surveillances. During the review, Independent Oversight found no overdue surveillance tests.

Many of the completed ventilation and fire suppression TSR surveillances contained significant deficiencies. Deficient areas included inadequately defined limits and acceptance criteria, incorrect test conditions/lineups, and inaccuracies in conducting and documenting the test results. For the fire suppression system, some performance tests that are conducted should be defined as TSR surveillance tests. Details of the individual TSR surveillance tests are listed below:

- The transient combustible control inspection TSR surveillances do not have criteria for flammable liquids in gloveboxes and do not properly define safe storage requirements for flammable liquids and other flammables in laboratory rooms. (Addressed in more detail in Section E.2.1)

- The Independent Oversight team identified open bypass valves on a number of safety-class Zone 1 and Zone 2 HEPA filter plenums, which had the potential to invalidate the results of TSR surveillances and represent a loss of safety-class boundary control. The positions of these valves were not included in the TSR surveillance procedure. (Addressed in more detail in Section E.2.1)

- The Zone 2 recirculation and bleed-off HEPA filter efficiency test procedures do not meet TSR surveillance test requirements for multiple-stage HEPA filters. (Addressed in more detail in Section E.2.1)

- TSR surveillance test procedures for Zone 2 bleed-off HEPA filter efficiency do not address potential bypass leakage from the idle trains into the filter outlet plenums of the trains being tested. (Addressed in more detail in Section E.2.1)

- The confinement doors' TSR surveillance procedure contains a table of flow orifice differential pressure versus flows that is substantially in error. (Addressed in more detail in Section E.2.1)

- The annual fire pump performance test is not a TSR requirement, as it should be, but rather is tested as part of the IWM process and contains no acceptance criteria. (Addressed in more detail in Section E.2.1)

- The annual diesel-driven fire pump test data was not corrected to account for engine speed variation. (Addressed in more detail in Section E.2.1).

- Surveillance TSR-102A-R00.4 was conducted on February 24, 2005, to verify the southeast confinement doors' leakage rate. On the Test Results Form (Attachment A), leakage rate verification test results were not circled as Sat/Unsat as required, although the data documented within the surveillance test indicated that the leakage was acceptable. In addition, the comments section of Attachment A provided information that made it unclear whether the condition of the door after the test was satisfactory with the entry, "Initiate Corrective Maintenance to better secure the small door. The top and bottom latches are not holding the door securely." The comment section, however, did not mention the operational status of the small door.

- Surveillance TSR-105A-R0.2 was conducted on February 24, 2005, for the HEPA efficiency test of HVP-809 Supply Filter Plenum, and TSR-102C was conducted on January 6, 2005. The HEPA filter test results included the test equipment computer printouts, which demonstrated that both HEPA surveillance tests passed the required efficiency; however, data recorded on the surveillance test data sheets was in error, and the final calculation of efficiencies from this recorded data was also in error.

- Surveillance TSR-301-R02, performed on September 28, 2005, to test the fire pump, was observed by the Independent Oversight team. The pre-job briefing was adequately conducted, and the overall performance of the test was adequate, except that test workarounds were necessary due to lightning strike damage to the fire alarm control panel and pump controller panel the evening before. These workarounds were verbally agreed to with the Operations Center but were not written into the surveillance test procedure as required by the temporary procedure change process.

Finding #19. Several LANL TA-55 TSR surveillances for the important-to-safety ventilation and fire suppression systems do not meet 10 CFR 830 requirements in such areas as specific system alignments for all modes of operation and specific and unambiguous surveillance limits supported by documented technical bases.

Summary

TA-55 has appropriately established an adequate control process for the conduct of TSR surveillances. The issuance and completion of surveillances is closely tracked, and TSR surveillances were performed on time. However, the quality of completed surveillances for the ventilation and fire suppression systems were significantly deficient in many areas. These include the failure of test procedures to clearly define the acceptance criteria and correctly establish the required test conditions, and improper documentation of the test outcomes. Some surveillance test assumptions/ parameters were not supported by adequate technical documents. Overall, the identified deficiencies reduce the assurance that the important-to-safety ventilation and fire suppression systems are capable of performing their safety functions. Because an effective TSR surveillance program is essential to maintaining the safety envelope of the facility, significant deficiencies in this area require immediate attention.

E.2.4 Maintenance

Independent Oversight's review of maintenance focused on the adequacy of maintenance procedures, the documentation of performed maintenance activities, and the facility's material condition. It included interviews with personnel responsible for maintenance activities and a review of procurement processes, condition assessment surveys, and deferred maintenance.

The PF-4 maintenance program was found to be adequate in the areas of material condition, preventive maintenance, and post-maintenance testing. Based on several PF-4 walkdowns, the facility's material condition was good, especially the ventilation and fire suppression systems. The individual ventilation system components, including fans, fan belts, motors, valves, HEPA filters, and fire suppression components (including valves and fire pumps), were in good working condition, and components in service were operating correctly. The out-of-position safety-class ventilation valves for the Zone 1 and Zone 2 HEPA filters, as discussed in Section E.2.1, were an exception. In addition, the overall housekeeping in the facility was good.

The major contributor to the reliability and good material condition of the ventilation system components is the well implemented vibration analysis preventive maintenance program. The safety-significant ventilation fans and motors at PF-4 are routinely tested for excessive vibration. In addition, other routine preventive maintenance tests are conducted as part of a documented preventive maintenance program. Results are provided quarterly to the System Engineer, and corrective maintenance is promptly undertaken to address identified deficiencies. Additionally, the maintenance and repair program for the diesel-driven standby fire pumps is comprehensive and fully implements the vendor's recommended maintenance schedule. Prompt performance of corrective maintenance has resulted in little or no maintenance backlog for the ventilation and fire suppression systems.

Post-maintenance testing performance and documentation were mostly adequate for a representative sample of PF-4 safety system work packages. The post-maintenance tests were adequate to demonstrate operability, but weaknesses were identified in the supporting documentation in some cases. For example, the post-maintenance test for a recent fan bearing replacement correctly defined the required test as satisfactorily completing a vibration test after the fan was run for over 15 minutes. The test documentation in the work package showed the results as meeting test parameters. However, the test data sheet was not well structured to match the data being recorded.

The methods for addressing deferred maintenance included various funding sources, including Facility Infrastructure Revitalization Program (FIRP), Readiness in Technical Baseline Facilities (RTBF), and corrective maintenance. Although some deferred maintenance is being completed under the different funding sources, the work is not being performed optimally in priority order.

The FIRP is a funding source that provides for the repair/replacement of only a portion of the 2003 Condition Assessment Information System (CAIS) records. By NNSA direction, further updates to the CAIS in 2004 were not used to update/modify the selection of tasks for the FIRP, and the FIRP was limited to repair/replace only items originally selected from the 2003 CAIS. As a result, some deferred maintenance tasks being completed by the FIRP during the current fiscal years do not match the current deferred maintenance priority list in the CAIS database.

The RTBF is the funding source for maintaining TA-55 in a warm standby condition. Examples of currently funded projects include the 13.2 kVa Switchgear Upgrade, PF4 & PF6, Emergency Lighting Replacement, RLW Line Replacement & Heat Exchangers, Facility Control System (FCS) Hardware/ Software Upgrade, and North and South Stack Monitors Relocation. Although none of these tasks are associated with CAIS tracking numbers or records, they update the capability of the plant and improve facility systems. TA-55 has proposed deferred maintenance tasks for fiscal years (FYs) 2006, 2007, 2008, and 2009 in a prioritized list to be funded by the RTBF.

As a path forward to improve funding of deferred maintenance, the FY 2006 Maintenance Budget Guidance directs maintenance budgets to consider deferred maintenance reduction. Specifically, five percent of the maintenance budget is to be targeted for high-priority deferred maintenance for mission-essential facilities. This approach will be part of the annual maintenance planning process.

LANL has established an adequate condition assessment survey process to determine deferred maintenance priorities. However, TA-55 condition assessment surveys are not fully used as a decision-making tool for prioritizing deferred maintenance. The current prioritized list of deferred maintenance for RTBF funding approved by TA-55 facility management does not indicate careful consideration of the records in CAIS. In addition, a few factors limit the CAIS information's usefulness. For example, it is difficult to keep CAIS up to date with current conditions because, as maintenance is completed to correct deferred tasks, there is some delay before the CAIS records are manually updated. One reason for CAIS not being current is that CAIS is not linked to Computerized Maintenance Management System (CMMS). LANL is proceeding with a project in FY 2006 to link CAIS records with CMMS. In addition, CAIS is not electronically available to TA-55 users. Within three months, CAIS is expected to shift to a web-based application that will provide easy access to all users.

However, significant weaknesses were identified in the implementation of ventilation system vendor manual recommendations, procurement processes, maintenance history, and the Maintenance Implementation Plan. The PF-4 important-to-safety ventilation system contains numerous types and manufactures of fans, motors, and dampers. The ventilation system engineers do not have the necessary vendor manuals for all these components. Without the vendor manuals, the system engineers have not been able to evaluate vendor recommendations and implement appropriate requirements into preventive and corrective maintenance procedures. During the review, the vendor manual for one type of ventilation fan was retrieved from the manufacturer's Internet site and reviewed for implementation of recommendations. The following deficiencies were noted when the current maintenance procedures were compared to the manual recommendations:

- Some of the preventive maintenance procedures require greasing bearings when the fan is not running. The vendor manual calls for the bearing to be greased only when the fan is running.

- The preventive maintenance procedures require verification that set screws are tight after maintenance; however, the vendor manual provides specific torque values not stated/used in the procedure.

- The preventive maintenance procedures check belt tensions by skill of the craft, without specific specifications. The vendor manual recommends that the checks be based on the belt manufacturer's specific belt tension requirements.

- PF-4 operators do not routinely rotate the lead and lag safety-significant fans, and as a result, the lag fan sits idle for a month at a time. The associated fan vendor manual recommends that for a fan not running for a long period of time, the fan wheel should be rotated by hand at least every two weeks to redistribute the grease on the internal bearings. This recommendation is not being implemented.

Finding #20. LANL has not implemented or documented exceptions to the vendor manual recommendations in the maintenance procedures for the PF-4 important-to-safety ventilation systems.

Independent Oversight reviewed several corrective maintenance work packages, focusing on the use of qualified parts. Several work packages did not include supporting documentation to demonstrate that the replacement parts were certified to the proper quality level. Examples include:

- Several corrective maintenance tasks were completed on the FCS using spare parts that were not certified as required to Management Level 2 (ML-2). The use of uncertified parts reduces assurance of system operability.

- For fan FE 863 (Work Order Task 00232719), the package included a work instruction and a post-maintenance test data sheet. The work instruction did not require the use of a certified ML-2 replacement bearing as required for a safety-significant system. As a result, no supporting documentation was in the package or available to certify that the bearing was purchased as ML-2.

- For the replacement of the diesel fire pump heat exchanger filler neck and cap (WO 00218968-01), the work order task instructions required ML-2 documentation, but none was present in the package.

- The spare part storage area in PF-4 for fan replacement parts does not retain the ML-2 receipt paperwork. Therefore, when these parts are used to repair safety-significant fans/motors, the required documentation is not available for the work packages.

Finding #21. LANL has not rigorously documented and certified in work packages the use of Management Level 2 purchased material as replacement parts in important-to-safety systems at PF-4, potentially degrading these systems.

The maintenance history for important-to-safety systems at PF-4 is not captured and maintained in a system that permits timely retrieval for a specific component. An Independent Oversight team request for the maintenance history on a specific fan was extremely difficult for the PF-4 staff to fulfill. In essence, the staff had to conduct several general searches and eliminate records (work packages). When individual work packages were retrieved, some were incomplete even though the work packages were closed. Further investigation determined that important work package documents had been retained by the technician who performed the work. The entire process was inefficient and time-consuming, and the end result did not demonstrate that the material history was known for a specific component. These deficiencies in maintenance history had been previously identified during the LASO SSO review.

The Maintenance Implementation Plan for TA-55 was recently revised as part of the new LANL Maintenance Implementation Plan. In some cases, the new plan does not accurately describe current maintenance implementation with respect to known deficiencies and does not provide clear implementation planning milestones and supporting details. For example, the LANL Maintenance Implementation Plan states that maintenance history is readily available for use, when in fact there are significant deficiencies in the ability to retrieve maintenance history, as verified during this Independent Oversight review and previous reviews. In most of the sections, the description of the path forward to reach full implementation provides little detail, and intermediate milestone and task descriptions are missing.

Finding #22. The LANL Maintenance Implementation Plan for LANL TA-55 does not always accurately describe current implementation with respect to known deficiencies and does not provide clear implementation planning milestones and supporting details.

Summary

Some aspects of the maintenance program are adequate, including the good PF-4 material condition, satisfactory preventive maintenance, and post-maintenance testing. Weaknesses were identified in the implementation of the ventilation system vendor manual recommendations; the prevalent use of uncertified parts in several safety systems, potentially degrading these systems; the lack of maintenance history; and a deficient Maintenance Implementation Plan.

E.2.5 Operations

The Independent Oversight team evaluated operating procedures and operator training for the safety-significant ventilation and fire suppression components. Independent Oversight also reviewed the knowledge and capability of the operators and facility supervisor(s) to operate PF-4 under normal conditions and to take appropriate actions in abnormal and accident conditions.

Facility conditions are monitored in the Operations Center 24 hours a day by assigned operators, supported by facility operator technicians. The Operations Center provides detailed displays of operating conditions with the FCS and other alarm panels for criticality and airborne radioactivity. The operators have limited capability to operate equipment from the Operations Center; it mainly consists of starting and stopping PF-4 ventilation fans and bypassing fire alarm signals during testing. An additional system enables operators to shut down banks of ventilation system fans as part of the Hardwire shutdown system.

Operators and supervisors are experienced and knowledgeable of plant systems and the Operations Center displays and controls. During interviews, they were able to demonstrate and explain the different FCS displays and capabilities and simulate the appropriate responses to abnormal conditions with the ventilation system.

Facility operator technicians are also experienced and knowledgeable of ventilation and fire suppression systems. Interviews and walkdowns were conducted with some of the facility operator technicians during performance of their normal duties, including log taking and manual operation of ventilation fans. Both these tasks were supported by detailed and well written procedures that included a complete match between the labeling of components in the facility with those referenced in the procedure. The technicians demonstrated the correct response to out-of-specification readings and abnormal plant conditions, including abnormal bearing noises or temperatures, and demonstrated the ability to rigorously follow a step-by-step procedure.

Operators and facility operator technicians have completed defined qualification cards, but the process is not as rigorous as required by DOE Order 5480.20. This situation was identified during the management self-assessment as a pre-start finding. The compensatory measure for the pre-start finding was to verify, based on a limited set of oral exam questions and work observations, that the operations staff was fully qualified. The formal corrective actions to the training finding are being developed.

Several weaknesses were identified in some of the processes implemented by the Operations Center in the areas of system configuration control, configuration locks, alarm response procedures, and temporary procedure changes. These include:

- PF-4 has not developed ventilation system component/valve lineup lists to ensure that these systems are properly configured for startup and periodically during operation. As stated in Section E.2.2, the ventilation systems are not supported by drawings that include component numbers, and many major components, including some safety-class pressure boundary valves in PF-4, are not labeled.

- The Operations Center operators use chains and locks to control some major ventilation system valve/damper positions. The use of configuration locks is not defined by an operations procedure, and a list of currently applied configuration locks, including component numbers, positions, and approvals, is not maintained. The application of configuration locks is not verified periodically.

- Several deficiencies were identified in the ventilation alarm response procedures. The procedures have not been reviewed and/or updated in several years, are not controlled, have no revision numbers, or are not written to the proper conduct-of-operations format. In addition, the ventilation alarm response procedure is silent on the use of the FCS to mitigate PF-4 cascading delta pressure abnormalities. The operation of ventilation fans from the FCS has been used on several occasions to resolve abnormal pressure conditions in PF-4 and should be evaluated as one of the responses in the ventilation alarm response procedure.

- Operations Center operators did not fully implement the clearly defined temporary change process when required to update or temporarily modify a TSR surveillance. In one case, the monthly TSR surveillance to check the operation of the laboratory doors (TA55-TSR-004) lists all the doors in a table, but Door 401 was not included in the table as required. During the two most recent performances of the surveillance, Door 401 was added in the comments section. The correct approach should have been to follow the TA-55 Change Control Manual on procedure changes, and to immediately perform a temporary procedure change upon discovery of the procedure deficiency. In the second case, as discussed under Surveillance and Testing (Section E.2.3), in the performance of TA55-TSR-301, procedure changes were required because portions of the fire alarm control panel had been damaged by lightning. The changes were not formally made using the temporary change process, but rather by verbal agreement. In every case, changes to such procedures should also have undergone the USQ process, as required by procedure OST-300-00-06B, Rev 3, and this requirement should have been reflected in the T-55 Change Control Manual.

Finding #23. LANL TA-55 operations are deficient is some areas, including the lack of approved safety system lineup procedures for some important-to-safety systems, lack of some periodic lineup verifications, lack of control of configuration locks, out-of-date ventilation alarm response procedures, and poor implementation of the temporary procedure change process.

Summary

PF-4 supervisors, operators, and technicians are knowledgeable of the operations and controls of the ventilation and fire suppression systems and have completed a qualification process. Their qualification requirements are being updated to meet the requirements of DOE Order 5480.20, as identified in a management self-assessment finding. The operating procedures used to operate the PF-4 ventilation system are adequate. Significant weaknesses were identified in the configuration control by the Operations Center operators of the PF-4 ventilation systems. The operators lack a set of system component lineup procedures, and the current component labeling is not complete. As a result, the lineup of the ventilation and other important-to-safety systems is not periodically performed. Other weaknesses include the lack of control of configuration locks, the outdated alarm response procedure for ventilation systems, and the poor implementation of the temporary procedure change process.

E.3 Conclusions

Significant deficiencies were identified in all functional areas that were assessed, including engineering design and analyses, the authorization bases, configuration management, surveillance and testing, maintenance, and operations. Although the overall designs of *most* aspects the PF-4 HVAC and fire suppression systems are generally adequate, there are, nonetheless, significant discrepancies or voids in the designs, analyses, and authorization bases, and in the translation of these into facility procedures and practices in both systems, that could prevent or degrade the full performance of their design-basis safety functions or could render them non-conservative with respect to requirements. Many aspects of configuration management at PF-4 are inadequate, including configuration documentation, system lineup controls, document control, safety bases maintenance, and the USQ process, including the PISA process. These weaknesses have been significant contributors to above-described technical weaknesses. Although TSR surveillances have been performed on time, various inadequate testing and surveillance practices and procedures reduce the intended assurance that the facility's important-to-safety ventilation and fire suppression systems are fully capable of performing their safety functions. Some aspects of facility maintenance are adequate, including very good housekeeping and material condition, satisfactory preventive maintenance implementation, and adequate post-maintenance testing. However, other aspects of facility maintenance are less than satisfactory, including poorly implemented equipment vendor recommendations on the ventilation systems, uncertified parts routinely used in safety systems, the general lack of maintenance history, and a deficient Maintenance Implementation Plan, all of which have the potential to degrade these systems. PF-4 supervisors, operators, and technicians are knowledgeable and well qualified on the ventilation and fire suppression systems, and their qualification requirements are being updated to comply with DOE Order 5480.20. Although the operating procedures were generally adequate, ventilation system configuration control was poor due to the absence of component line-up procedures, lack of component numbering, no formal control of configuration locks, outdated alarm response procedures, inadequate control of combustibles, and poor implementation of the temporary procedure change process. The weaknesses that were observed in all of these technical areas, in combination with low levels of rigor, discipline, attention to detail, and questioning attitude in implementing nuclear safety requirements, indicate a general, broad-based deficiency in the nuclear safety programs required for a hazard category 2 DOE nuclear facility at TA-55. In view of these observations, LANL's feedback and improvement systems (see Appendices D and F) and LASO's oversight and stewardship of this facility have been significantly deficient. Some of the deficiencies, such as the inadequate technical basis for combustible controls, ventilation system lineup, and fire and seismic event analysis, warrant immediate compensatory measures. The other deficiencies warrant rigorous evaluations, including extent-of-condition reviews and identification of causal factors, on an accelerated basis to identify near-term and longer-term corrective actions that will ensure safe operation of this nuclear facility and effective implementation of safety requirements.

E.4 Ratings

Engineering Design .... SIGNIFICANT WEAKNESS
Configuration Management .... SIGNIFICANT WEAKNESS
Surveillance and Testing .... SIGNIFICANT WEAKNESS
Maintenance .... NEEDS IMPROVEMENT
Operations .... NEEDS IMPROVEMENT

E.5 Opportunities for Improvements

This Independent Oversight inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

Los Alamos Site Office

1. **Identify and implement compensatory measures needed to ensure the safety of continued facility operations while deficiencies are being fully analyzed.** Because of the safety importance of certain deficiencies identified during this Independent Oversight inspection, prompt compensatory measures are needed to reduce the risks of continued operations. LASO, in coordination with LANL, should evaluate the identified deficiencies to determine which of them warrant prompt compensatory measures and then promptly develop and implement appropriate compensatory measures to reduce risks to acceptable levels pending more detailed analysis. Four areas of deficiencies warrant specific prompt compensatory measures: inadequate combustible load surveillance, deficiencies in configuration management that allowed misalignment of numerous ventilation system bypass valves, and inadequate analyses of the potential for a Zone 1 header failure and PF-4 seismic event. Opportunities for Improvement #1, #2, and #3 under LANL provide more specific information about compensatory measures and longer-term actions to consider for these areas. This initial analysis may identify other areas that also warrant prompt compensatory measures.

Los Alamos National Laboratory

1. **Develop prompt compensatory measures and longer-term actions to address the inadequate combustible loading surveillance program.**

   - Specific prompt compensatory measures to consider include:

     – Establish explicit combustible load criteria based on high temperature restrictions from the FHA for gloveboxes and laboratory rooms for both flammable liquids and combustible solids.

     – Implement the minimum required distances between the transient combustibles and the gloveboxes.

- Inventory the present facility combustible loading condition for comparison with the new criteria.
- Take corrective actions as necessary in areas where the combustible loading limits are exceeded.
- Revise the surveillance procedures to accommodate the new combustible load criteria derived from the results of these analyses.

- Specific longer-term actions to consider to determine combustible control limits include:
  - Recognize that the control criteria due to HEPA filter fire-induced soot loading may be more restrictive than the temperature-based criteria.
  - Perform a detailed analysis of the allowable combustible loadings for all material types (e.g., combustible liquids, cellulose, and plastics), including both permanent and transient materials, and address individual facility rooms and gloveboxes based on the most limiting fire-induced parameters (allowable filter temperatures, allowable filter combustion product loading, thermal stresses, etc.).
  - If this limit is more restrictive that the limit determined for the prompt compensatory actions identified above, take corrective actions where combustible control limits are exceeded.
  - Revise the TSRs to include the specific limits derived from the results of these analyses.
  - Revise the FSARs and FHA to address these new analyses and limits.
  - Revise the combustible loading control procedures to reflect the new TSR requirements.

2. **Develop prompt compensatory measures and longer-term actions to address the deficiencies in configuration management that allowed misalignment of several ventilation system bypass valves.**

   - Specific prompt compensatory measures to consider include:
     - For the safety-class and safety-significant ventilation systems, using the best available drawings, perform and document a system lineup verification to ensure that no other components/valves are out of position.
     - In a similar fashion for other mechanical systems that are important to safety and that are not covered by existing system lineup verification procedures, using the best available drawings, perform and document a system lineup verification to ensure that no other components/ valves are out of position.
   - Specific longer-term actions to consider to establish several fundamental foundation blocks for effective configuration management, starting with the facility HVAC systems and continuing for all safety systems and their supporting systems, include:
     - Generate accurate, detailed as-built piping and instrumentation drawings of the systems.
     - Assign unique numbers to all system components (this may require first establishing a component numbering scheme), particularly those subject to operation, changeout, calibration, manipulation, maintenance, testing, etc., or that provide control for, power to, or support for these SSCs.
     - Physically affix these numbers to these components using permanent, durable, easily readable identification media (tags, labels, signs, etc.).

- Establish conduct-of-operations policy standards requiring that all procedures for such systems for operations, testing, maintenance, etc., include system lineup lists for normal, abnormal, and accident conditions, and that procedural directions include the component numbers, as appropriate.

- Revise all such procedures to apply these conduct-of-operations standards.

3. **Develop prompt compensatory measures and longer-term actions to address the potential failure of the Zone 1 header as a result of laboratory room fires or seismic events.**

   - Specific prompt compensatory measures to consider include:

     - Initiate the PISA process for these deficiencies.
     - Issue an Operations Center standing order to immediately shut down all PF-4 fans if a laboratory fire or seismic event occurs.

   - Specific longer-term actions to consider include:

     - Evaluate options for upgrading the Zone 1 header to safety class (including thermal and seismic qualifications).

     - Evaluate options for retaining the Zone 1 header safety-significant designation (which requires a seismic qualification) and restoration of the demister system to safety-class category.

4. **Address deficiencies identified in the FCS and associated testing.** Specific actions to consider include:

   - Include a review of initial test records to determine whether any components were rejected during this testing.

   - Develop a testing strategy based on all available failure information, including initial testing and subsequent failures, and document and implement results of the component failure analysis.

   - Initiate the PISA process for this deficiency.

5. **Further evaluate the diesel fire pump.** Specific actions to consider include:

   - Evaluate and analyze the installed diesel exhaust configuration and analyze for external load effects.

   - Reevaluate diesel fire pump performance test data and normalize data to the test acceptance engine speed of 1750 rpm. Reevaluate pump degradation accordingly.

6. **Perform analysis and modifications to address identified design and analysis deficiencies.** Specific actions to consider include:

   - Locate, verify the technical adequacy of, and enter into the facility document control system all documentation to demonstrate the qualification of the facility's important-to-safety HEPA filters for the environmental conditions that result from the design basis fire.

   - Perform appropriate modifications to alleviate the low flow/pressure condition in the fire suppression system. Reevaluate the facility Ordinary Hazard Group 2 fire hazard classification.

   - Perform modifications to seismically support sprinkler piping throughout the PF-4 facility.

   - Perform thermal stress analyses of the facility's safety-class HVAC components, including ductwork, to verify that it can remain intact in design-basis fire conditions. Make design changes as required.

   - Perform failure modes and effects analyses for all accident scenarios for the facility HVAC systems, including the design-basis seismic event, to assure that the actual worst-case scenarios have been identified. Make design and authorization basis changes as required to incorporate the worst-case conditions not previously identified.

- Perform complete analyses of the effects of wind on accident exposures, including the differential pressures across the facility's outside surfaces (and the resultant increase in building leakage) and the effects of wind speed versus leakage diffusion in order to determine the speed at which the diffusion effects fully offset the increased leakage effects. Adjust the TSR building pressure limits with respect to outside static pressure accordingly to ensure that exposures remain as low as reasonably achievable and within evaluation guidelines.

- Revise the design of the building outside static air pressure sensing probes to assure that they provide more accurate sensing for the range of normal wind conditions, including relocation away from the roof edges and redesign of the probes themselves to minimize vertical wind component effects.

- Perform modifications as required to fully qualify fire suppression piping in the facility for the design basis seismic event.

- Perform modifications/analyses as required to resolve current pressure/flow deficiencies in the fire suppression system.

- Perform modifications/analyses as required on the diesel-driven fire pump exhaust to assure that it is fully qualified for the design basis seismic and wind events.

7. **Improve operations in the areas of configuration control, alarm response procedures, and the temporary change control process.** Specific actions to consider include:

   - Develop and implement ventilation system component/valve lineup procedures that are supported by the correct drawings and full implementation of component numbering and labeling programs.

   - Develop and implement an operations procedure for control of configuration locks.

   - Revise and implement a new ventilation alarm response procedure that includes the expected actions to be performed by an operator to start up and shut down fans via the FCS.

   - Develop a system to mitigate/correct the alarm.

   - Retrain operators on the requirements of the temporary procedure change process and verify adequate implementation.

   - For completed surveillances and tests, ensure that the reviewing operator(s) evaluate and provide clear responses in the surveillance comment section to document component deficiencies (i.e., the corrective actions taken, how the component's condition affects the test, and whether the deficiencies are entered into the maintenance work log to be fixed in a timely manner).

8. **Improve maintenance in the areas of maintenance history, vendor manuals, procurement, and the Maintenance Implementation Plan.** Specific actions to consider include:

   - Improve CAIS by completing the software improvement that links CAIS to CMMS so that CAIS records are automatically updated when corrective maintenance is completed.

   - Improve CAIS by completing the software improvement that makes CAIS a web-based application.

   - Obtain the necessary vendor manuals for the PF-4 important-to-safety systems. Review and implement as appropriate vendor manual recommendation into maintenance procedures.

   - Develop and implement an operating procedure for the ventilation fans in PF-4 to ensure that the appropriate fans are rotated once each week.

   - Establish and implement a quality control review process for completed work packages to be conducted soon after the work is completed to ensure that the necessary documentation, data sheets, and procurement certification are included in the package.

- Review previous completed corrective maintenance work packages to ensure that procurement certification was adequate for work on safety-class and safety-significant systems. Correct any deficiencies in these work packages.

- Review currently obtained spare parts for safety-class and safety-significant systems for correct certification documentation and correct, as required, any deficiencies.

- Develop and implement the necessary software upgrades to CMMS to permit easy entry of maintenance history from completed work packages and also to allow easy access to this information by required users, including system engineers.

- Revise as necessary the current TA-55 Maintenance Implementation Plans to accurately capture current maintenance program deficiencies, and revise the required implementation plan with appropriate milestones and supporting detail.

9. **Establish and implement the following elements of an effective, comprehensive document control system, as part of the effort to improve configuration management.** Specific actions to consider include:

    - Generate document control procedures that establish the following basic elements:

        – The requirements for identification, cataloging, storing, marking, retrieval, duplication, issuance, etc., of all technical documentation in the facility, including but not limited to drawings, specifications, vendor documents, procedures (both uncompleted and completed), modification packages, and calculations

        – The document control organizational elements, including responsibilities and authorities.

    - Establish a document control center to house all of the organizational elements and provide facilities for document storage, duplication, issuance, etc., for this organization.

10. **Revise the FSARs and other AB documents to assure that they correctly and fully address the following AB weaknesses identified in this assessment**:

    - HVAC HEPA filter qualification temperature

    - Worst case event-caused equipment failure scenarios for the design basis seismic and fire events

    - Wind effects on building differential pressures

    - Whether or not there is a design basis tornado

    - The correct/consistent design basis straight line wind event

    - The correct configuration for the three Zone II bleed-off fans

    - The correct definition in TSR 5.6.5 of the third criterion that defines a USQ

    - In TSR 5.5, inclusion of the USQ process in the programmatic actions required for changes to TSR surveillances

    - Inclusion of discussion of HEPA filter quality assurance in the FSAR as indicated in the current FSAR

    - Inclusion of wildfire in the FSAR as a design basis event

    - Inclusion of the annual fire pump performance test as a TSR requirement, with appropriate quantitative acceptance criteria.

11. **Review all of the technical weaknesses identified during this assessment with respect to their impacts on the current FSAR (1996) and the pending revised FSAR (2002) and their associated AB documents.** Specific actions to consider include:

- Formally consider the PISA implications of each technical weakness and enter the PISA process where required.
- Perform corrective actions where required, including updating the current and revised FSARs and other related AB documents.
- As extent-of-condition measures, perform the same processes on all other discrepancies that were informally recognized in the FSARs and in other related AB documents and in the design, operation, maintenance, testing, etc., of important-to-safety systems.

12. **Address programmatic discrepancies in the USQ process.** Specific actions to consider include:

    - Revise the USQ procedure to correct the deficiencies identified during this assessment.
    - Conduct additional training for all TA-55 personnel performing USQ functions, with particular emphasis on the limitations of USQ screening vis-à-vis the requirements of 10 CFR 830.
    - Perform USQDs on the examples identified during the assessment where screenings incorrectly determined that USQDs were not required. As an extent-of-condition corrective action, considering the screening errors identified in this assessment and perform a 100 percent review of negative screenings for at least the past two years, correcting identified errors and performing the required USQDs.
    - Re-perform the one negative USQD identified by this assessment that may have incorrectly determined that the change was not a USQ.

13. **Revise test procedures and TSRs to correct identified deficiencies.** Specific actions to consider include:

    - Revise either the Zone 2 recirculation and bleed-off HEPA filter efficiency test procedures with regard to the testing of multiple filters in series versus single, individual filters, or revise the TSR requirements regarding this point in order to reconcile this inconsistency between these two documents.
    - Further revise the Zone 2 recirculation and bleed-off HEPA filter efficiency test procedure to either prevent or account for the potential bypass leakage from the idle train into the filter outlet plenum of the train being tested.
    - Revise the confinement doors TSR surveillance procedures to correct the table of flow orifice differential pressures vs. flow.
    - Revise the TSRs to add a TSR requirement for annual fire pump performance testing. Revise the corresponding test procedure to add acceptance criteria containing actual performance limits and the requirement to normalize test results to a standard nominal pump speed.
    - Revise procedure TA55-TSR-AP-030, Rev 00, Heat Loading Log for Temporary Storage of Pu238, to address the technical concerns identified in Section E.2.1.

APPENDIX F
MANAGEMENT OF SELECTED FOCUS AREAS

F.1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight (Independent Oversight) inspection of environment, safety, and health (ES&H) at the Los Alamos National Laboratory (LANL) included an evaluation of the effectiveness of the National Nuclear Security Administration (NNSA), Los Alamos Site Office (LASO), and the contractor – University of California (UC) – in managing selected focus areas. Based on previous DOE-wide assessment results, Independent Oversight identified a number of focus areas that warrant increased management attention because of performance problems at several sites. During the planning phase of each inspection, Independent Oversight selects applicable focus areas for review based on the site mission, activities, and past ES&H performance. In addition to providing feedback to the NNSA, LASO, and LANL, Independent Oversight uses the results of the review of the focus areas to gain DOE-wide perspectives on the effectiveness of DOE policy and programs. Such information is periodically analyzed and disseminated to appropriate DOE program offices, sites, and policy organizations.

The focus areas selected for review at LANL and discussed in this appendix are:

- Environmental management system and pollution prevention program (see Section F.2.1)
- Chronic beryllium disease prevention program (CBDPP) (see Section F.2.2)
- Hoisting and rigging (see Section F.2.3)
- Safety management for protective force training (see Section F.2.4)
- Safety system oversight (SSO) by the LANL system engineer program (see Section F.2.5).

The SSO review is discussed in this appendix, but the evaluation of this topic is reflected in the evaluation of the broader feedback and improvement systems in Appendix D. Similarly, the results of the review of the other focus areas are considered in the evaluation of the core functions of integrated safety management (ISM) in Appendix C and/or D.

F.2 Results

F.2.1 Environmental Management System and Pollution Prevention Program

Independent Oversight identified the environmental management system (EMS) as a focus area across the complex in response to DOE Order 450.1, *Environmental Protection Program*, which requires implementation of EMS at DOE facilities by December 31, 2005. Independent Oversight reviewed LASO and LANL implementation activities for EMS, focusing on the requirements of DOE Order 450.1 at the institutional level and within the Dynamic Experimentation (DX) Division.

LASO has set expectations for and been appropriately participating in EMS activities being performed by the contractor. LASO established contractual performance objectives for 2005 requiring LANL to maintain an EMS that was integrated into the LANL ISM system (ISMS). LASO is adequately monitoring LANL performance in achieving an EMS through review of LANL documents (including self-assessments and third-party assessments) and regular attendance at the LANL steering meetings.

A number of proactive actions and programs have been initiated at the institutional level to establish the EMS and implement it within all divisions and organizations. A LANL EMS Steering Committee was established in May 2004 by the Director, is chaired by the LANL Deputy Director, and includes members from all directorates and LASO. An EMS Team Leader from the Environmental Stewardship Division has been tasked with ensuring that EMS requirements are established, implemented, and maintained in accordance with International Standards Organization (ISO) 14001. This Team Leader also serves as the liaison between the divisions and the institution for implementing facility- and/or organization-specific EMS actions.

In establishing an EMS, LANL has elected to obtain ISO 14001 certification and has engaged a third-party registrant to perform a four-phase audit of the EMS to determine conformance to ISO 14001. The second phase of this audit was expanded to include a determination of whether the existing EMS met DOE Order 450.1 and ISO 14001 requirements, so that LANL could self-declare that the EMS conformed to DOE Order 450.1. In this second phase, the auditors determined that LANL's existing EMS met ISO 14001 requirements; therefore, LANL plans to self-declare that the EMS has been established at the end of October 2005. The last two phases (i.e., the Stage 1 and Stage 2 Registration Audits for third-party certification) will take place in early 2006.

The Los Alamos National Laboratory Environmental Management System Toolkit is a noteworthy communication tool that provides presentations on EMS and the documents that implement it. The Toolkit defines how EMS teams are to be established within the various line organizations to develop programs and define objectives and targets within the organizations. EMS personnel use this Toolkit effectively within their line organizations to educate line personnel and evaluate EMS implementation.

In addition to the Toolkit, LANL has taken other proactive steps to implement EMS. For example, LANL has included topics in General Employee Training that address general EMS awareness and pollution prevention. Information about institutional activities and progress within the line organizations is also posted on the LANL website.

To better sample EMS field implementation, Independent Oversight performed an in-depth review of EMS activities within DX Division. DX took several appropriate actions in fiscal year (FY) 2005 to achieve implementation of an EMS. A charter was signed by the DX Division Manager in February 2005 to establish commitments for implementing requirements of the LANL EMS (e.g., ensuring adequate resources). A team established to determine and prioritize significant environmental aspects of DX activities has appropriately identified three significant aspects (reduction in low-level waste, reduction in hazardous waste, and improvement in chemical management) and established action items for FY 2006 for those aspects.

Other actions taken by DX in FY 2005 included training briefings from the EMS Toolkit, which were tailored and then presented to the organizations as part of the continuing education on EMS. DX also assigned an intern to identify ways to reduce the amount of waste generated during experiments, which resulted in reductions in the use of sandbags and cable and modifications to silos that allow their reuse.

The LANL pollution prevention (P2) program tracks the generation rates by organizations and then targets the largest generators for increased support. This approach has resulted in more support to DX, which is one of the largest generators at LANL. Overall, LANL has a strong P2 program, which has received numerous awards. At the institutional level, this program includes process for prioritizing and funding P2 projects submitted by the Divisions, which is funded by a generator set-aside fee (funded by a tax on the cost of disposal of regulated and radioactive wastes).

LANL has established the Project Requirement Identification Document as an electronically administrated process to evaluate new projects to ensure that environmental permits are obtained in a timely manner. The P2 program is included in this process to identify opportunities to apply pollution prevention during project planning. However, the P2 staff at the institutional level do not review all the projects submitted for review, and the process currently does not allow submitting the projects to the P2 staff within the requesting organizations.

One FY 2005 award fee that was not achieved was incorporating EMS elements into the ISMS description. Although the EMS elements have been developed and included in a revised description, LANL decided not to issue its revised ISMS description until after the award of a new contract. As an interim solution, a LANL Environmental Management System Description Document was issued on September 12, 2005, that shows that the EMS meets ISO 14001 and DOE Order 450.1 requirements.

Summary

LANL established its EMS to conform to ISO 14001 provisions and plans to self-certify its EMS in October 2005, well before the December 31, 2005, deadline. LANL is seeking certification under ISO 14001, and divisions are currently taking action to implement the EMS within their operations. The EMS Toolkit is a noteworthy practice for assisting in EMS implementation. The EMS at LANL, although integrated within ISM, has not yet been documented in the LANL ISMS description document. LANL's award-winning P2 program includes a funding set-aside process for P2 projects and processes for reviewing new activities to identify P2 opportunities during the project planning phase.

F.2.2 Chronic Beryllium Disease Prevention Program

DOE has established regulatory requirements for the CBDPP in 10 CFR 850. The rule, which is intended to protect workers and prevent exposure to beryllium, establishes medical surveillance requirements to ensure early detection of chronic beryllium disease, provides for training to alert workers of the hazards associated with exposures to beryllium, and provides for a reduction in the number of workers currently exposed to beryllium in the workplace. DOE has also developed guidance (DOE Guide 440.1-7A) to assist line managers in meeting their CBDPP responsibilities. This Independent Oversight review focused on LASO and LANL implementation of the CBDPP.

Beryllium was historically and is presently used at LANL in a variety of forms and for a variety of purposes within the LANL weapons and research programs. In addition, as discovered through extensive testing, beryllium can be found in the soil, in rocks and minerals, as metal alloys used in consumer products and electronic components, and in a wide variety of other forms that are encountered on a daily basis at LANL. LASO and LANL have performed the necessary investigations, baseline characterizations, and sampling to establish a site-specific baseline inventory and a sitewide, consolidated CBDPP. The CBDPP is controlled by the LANL Health, Safety and Radiation Protection (HSR)-5 group and is managed by a certified industrial hygienist, who has been in the position for the past four years. LANL also maintains Laboratory Implementation Requirement (LIR) 402-560-01, *Beryllium Use*, which delineates site requirements for beryllium use at all site locations; this LIR is currently undergoing revision. Recent assessments of the LANL beryllium program by the Office of Inspector General in 2003 and a LANL/DOE internal review in 2004 determined the general beryllium program to be in compliance with 10 CFR 850.

LANL established its Beryllium Technology Facility to machine, inspect, process, and characterize beryllium components in an ultra-clean, ventilated, and thoroughly sampled environment; this facility was the first such facility in the DOE complex. Other LANL divisions perform research and development activities that involve beryllium in various quantities and need to be closely controlled and monitored. Research is currently under way to develop new methods of detection, mitigation, and cleanup of beryllium, as well as methods to reduce the chance of sensitization or disease among workers at beryllium facilities.

LASO and LANL perform the annual CBDPP review as required in 10 CFR 850. Other site contractors, such as KSL, are required to follow the consolidated site CBDPP and are provided the opportunity to comment on the CBDPP during the review process. LASO has included the site beryllium program in the Appendix F performance criteria section of the LANL contract, which has provided extra emphasis and oversight for the CBDPP. LASO and LANL have also developed specific criteria to evaluate and score the Appendix F performance objectives for the beryllium program; these criteria are consistent with the rule and measure performance in protecting site workers. LASO and LANL also review and evaluate multiple sources of information about the beryllium program, such as occurrence reports, elevated sampling results, positive laboratory reports, beryllium program statistics, and other beryllium-specific information. The resulting information is used to develop the feedback and improvement analysis required by 10 CFR 850, which is intended to monitor and prevent unnecessary increases in the potential for exposure of workers to beryllium disease.

LANL maintains two certified beryllium testing laboratories. The Chemistry Division manages both analytical facilities and processes breathing zone and surface samples collected from a variety of site locations. Some LANL contractors, such as KSL, have elected to send their beryllium samples to an outside laboratory, which is also accredited by the American Industrial Hygiene Association. The samples sent off site are monitored by the KSL safety and health staff but are not compared to the analytical processes and results used by LANL.

LASO, HSR-5, and Chemistry Division analytical personnel are all active in the DOE Headquarters beryllium working group and are interested in helping to solve the digestion concerns about beryllium oxides. The LANL Chemistry Division is also researching new and innovative techniques to analyze for the presence of beryllium using simpler chemical analytical methods and is currently field testing processes at several laboratory sites. The new techniques, which are funded by another Federal agency, could substantially reduce the cost and increase the effectiveness of the beryllium sampling with current methods.

LANL training staff provide beryllium health hazard training and refresher training for all site workers. LANL and KSL also provide various on-the-job and facility-specific training and/or refresher training. The training classes fulfill the requirements of the 10 CFR 850 rule. The HSR-5 beryllium coordinator monitors worker participation in training classes, assesses the quality of the training content, and monitors the training schedule for any significant changes in the number of workers seeking training.

The medical surveillance and counseling component of the CBDPP continues to be effective and in compliance with the beryllium rule. LANL databases track and generate the notices and forms necessary to offer and document the voluntary participation in medical surveillance for LANL beryllium workers. In addition, forms to convey the results of beryllium medical surveillance testing are processed by the examiner and HSR-2 support staff in the required time frames. Counseling is provided by the HSR-5 program coordinator and HSR-2 personnel if workers have questions about any aspect of the beryllium surveillance program. On average, 900 workers are in category 2 (current worker program) of the voluntary surveillance program and are scheduled for surveillance once a year, and 1500 are in category 3 (past worker program) and are scheduled for surveillance every three years. Historically, about 40 percent of the workers who are offered medical surveillance decline participation in the voluntary program. HSR-2 is also responsible for reporting to the DOE Beryllium Registry, and the databases needed to provide that information are currently effective and functional. To date, 17 individuals are considered to be sensitized, and 3 individuals have been diagnosed with chronic beryllium disease. Investigations of these cases have not determined any recent new exposures and are generally attributed to past exposures.

Independent Oversight observations of several different divisions, including locations in laboratories and the field, indicate that controlled beryllium areas are clearly marked with the required institutional signage. Beryllium workers appropriately implement personal protective equipment (PPE) requirements, and integrated work documents indicate that conservative measures are taken by researchers until sampling results verify that it is safe to use less-conservative PPE. Several areas within the Chemistry Division's Actinide, Catalysis and Separations Chemistry group that handled beryllium substances below any regulatory threshold chose to label fume hoods and work stations as an added safety precaution and a best practice. Environmental management of beryllium waste is controlled by using special disposal tags and containment measures, such as double plastic bags. Much effort is being expended to control any unnecessary environmental release of beryllium contamination by using newly established methods to contain beryllium contamination and clean up legacy areas.

Although generally effective, a few concerns were identified in implementation of beryllium protection measures. Some divisions have not fully implemented the IMP 300.2 process, which requires disclosure of hazards to co-located workers who may not normally recognize the presence of hazards, such as beryllium. Additionally, although specific legacy machine shop equipment used for beryllium operations has been surveyed, numerous machines used in specific laboratory locations, such as the Chemistry Division, have never been sampled for the presence of beryllium and are not included on a surveillance schedule.

Summary

LANL has established a compliant and comprehensive CBDPP as required by 10 CFR 850. LASO has provided the necessary support, direction, and oversight for ongoing beryllium program activities, including the annual CBDPP review, the Appendix F criteria, and the CBDPP program review. The LANL program coordinator appropriately manages the CBDPP. LASO and LANL are active in promoting research and development at the Headquarters and laboratory levels that could enhance the detection, containment, and safety of beryllium work and support efforts to minimize beryllium exposures.

F.2.3 Hoisting and Rigging

Independent Oversight identified hoisting and rigging as a focus area because Independent Oversight inspection results and site occurrence reports indicate that a number of sites have experienced events, near misses, and injuries during hoisting and rigging activities. Independent Oversight reviewed hoisting and rigging activities performed by the KSL Hoisting and Rigging group in support of LANL programmatic and maintenance work. The review of KSL hoisting and rigging activities included observation of lifting activities and crane maintenance, review of hoisting and rigging procedures and review of completed lift work packages.

The DOE requirements for hoisting and rigging have not accurately flowed down to the DOE-UC contract or to the activity level. General requirements for hoisting and rigging work by KSL's Hoisting and Rigging group are delineated in LANL LIR 402-1120-01.1 and KSL's Administrative and Operational Procedure, *Hoisting and Rigging* (12-25-003). These procedures reference the DOE *Hoisting and Rigging Standard*; however, the standard is not specified as a requirement in the DOE-UC contract Work Smart Standards, Appendix G. The only hoisting and rigging requirements listed in the UC contract are the general Occupational Safety and Health Administration requirements (i.e., CFR 1910 and 1926) and a 1997 American Petroleum Institute *Recommended Practices for Inspection, Maintenance, Repair, and Remanufacturing of Hoisting Equipment*. Furthermore, the LANL LIR bases its requirements on the use of the 1999 *Hoisting and Rigging Standard* but then specifies the 2001 version for physical qualification requirements later in the document. There is no indication that the most recent (2004) version has been integrated into either the procedure or the contract.

In addition, there are a number of differences between the current LANL *Hoisting and Rigging* LIR and the DOE *Hoisting and Rigging Standard* (DOE-STD-1090-2004). For example, LIR Section 7.1.3, *Inspections and Performance Tests*, *Inspections for Infrequently Used Overhead Lifting Equipment*, states that units formally locked out of service for less than a year need only have a monthly inspection to return to service. However, DOE-STD-1090-04, Section 7.2.8, *Cranes Not in Regular Service*, requires any crane that has been out of service for more than six months to undergo an annual inspection before its return to service. In addition, LIR Appendix D, section D.6, *Synthetic Web Slings*, does not include some of the removal criteria contained in DOE-STD-1090-2004, including: "Wear or elongation exceeding amount recommended by manufacturer" and "Knots in any part of the sling." As a result, some of DOE's current hoisting and rigging requirements could be missed, possibly resulting in an event or reducing the margin of safety.

Finding #24. LASO and LANL have not ensured that DOE hoisting and rigging requirements accurately flow down to LANL workers and subcontractors.

LANL and KSL personnel who perform hoisting and rigging activities have adequate qualifications and are provided adequate training and certification. All KSL Hoisting and Rigging group crane operators possess a State of New Mexico hoisting operators license. Operators are also required to have a minimum of 3 years (1500 hours of documented "hands-on") crane operation/rigging experience and pass a hands-on practical examination. Training and certification of LANL crane operators is coordinated through the National Commission for the Certification of Crane Operators on an annual basis, and certification lasts three years.

Inspection of hoisting and rigging equipment available for use at LANL facilities indicated that equipment was clearly marked with tags indicating when the slings and hoists are due for inspection. The rigging observed at the Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT) was all tagged, properly inspected, and in good condition.

Although few hoisting and rigging activities were performed at the inspected facilities during the Independent Oversight inspection, the Independent Oversight team observed one lifting activity. The lift was performed by the KSL Hoisting and Rigging group in support of the DARHT facility, involving the removal of 12 cells from the DARHT facility through the roof. Designated a critical lift, a complete integrated work document was prepared in addition to travel plans for the mobile crane and lift plans. The lift plans were detailed and adequately identified the maximum weight of the intended lift, the boom angle associated with the lift, the proposed lifting radius, the boom length, a copy of the load chart, and a current annual inspection of the crane. All aspects of the observed lift were performed correctly. The lifting crew and operators demonstrated good coordination and communication while performing the lift activities.

Summary

LASO has not ensured that DOE hoisting and rigging standards are included in the LANL work smart standards requirements. In addition, LANL requirements documents include incorrect and inconsistent references. As a result, some DOE requirements (such as requirements to examine for pinching or other conditions that could cause a failure) do not flow down to the activity level and could be missed by LANL or KSL during hoisting and rigging activities. Although requirements need to be addressed, KSL and LANL personnel who perform hoisting and rigging activities have good qualifications, and the observed lift was performed correctly and safely.

F.2.4 Safety Management for Protective Force Training

A March 2004 Inspector General report (DOE/IG-0641) identified weaknesses in some aspects of site basic security police officer training programs and identified a need for increased safety management involvement in protective force training. The DOE corrective action plan for weaknesses identified in the Inspector General's report committed Independent Oversight to examine selected aspects of protective force training from a safety management perspective during Independent Oversight ES&H inspections.

At LANL, the protective force is managed by Protection Technology Los Alamos (PTLA). The PTLA-UC contract is managed by the Security and Safeguards Division at LANL and requires PTLA to implement all applicable LANL safety requirements. In addition, LASO has a deployed security specialist at the LANL facility to provide daily monitoring and support for protective force program activities.

LASO safeguards and security management interacts directly with both LANL and PTLA security activities and provides oversight through an annual comprehensive security audit. The most recent audit, completed in August 2005, examined the safety of all security activities at LANL. The annual force-on-force exercise is extensively reviewed by LASO security and safety personnel, and the deployed security specialist is used as a trusted agent during exercise planning. LASO reviews all security and emergency site exercise planning for safety considerations, including interfaces with external organizations that participate in LANL exercises, such as local law enforcement. LASO also participates in the local LANL firearms safety committee, the protection program management team, monthly PTLA safety committee meeting, live and simulated firearms training exercises, and the annual training management planning process. The deployed LASO security specialist tracks observations and issues, including safety concerns, on daily surveillance forms. LASO security personnel indicated that they have a high level of confidence in PTLA's ability to conduct protective force training safely in a wide variety of activities, including force-on-force exercises and live-fire conditions.

A selective review of protective force training documentation developed by PTLA indicated that safety considerations were thoroughly integrated into all protective force training activities. Hazards assessments, lesson plans, safety briefing materials, and procedures that provide direction for range safety were comprehensive and closely followed the DOE Firearms Safety Standard requirements. Of special interest was the PTLA adaptation of the integrated work document called the Hazard Identification and Mitigation Plan (HIMP), which was originally issued by PTLA and accepted by LANL in June 2001. The HIMP policy and associated procedure are currently undergoing an extensive revision and will include IMP 300.2 language and requirements. The HIMP process follows ISM principles and core functions and the risk assessment report format in the DOE Firearms Safety Standard. The hazards and controls listed in the live-fire range HIMP were comprehensive and tailored to the specific conditions at the LANL outdoor range facility.

PTLA management maintains a Director position for Environment, Safety, Health and Quality Assurance. This position is currently held by a safety professional and is responsible for maintaining all safety documentation, safety assessments, safety committee activities, safety issues management, safety statistics, trending analysis, and communications to the protective force concerning safety. A monthly publication from the safety director's office compiles PTLA injury/illness statistics, safety information, issue resolution, and educational information and encourages feedback from employees. This publication uses an innovative approach to communicate safety information to the PTLA protective force, tailors the safety information to the audience, and is an integral part of the PTLA training and education process.

LANL HSR-5 personnel provide industrial hygiene support for the PTLA live fire-range. LANL is considering establishing a part-time deployed position for this support, but a formal agreement with PTLA has not been finalized. Although no specific deficiencies were noted in the observed activities, industrial hygiene monitoring of protective force training activities at both indoor and outdoor firing ranges is becoming a more specialized discipline, new weapon systems are being introduced more frequently, and training requirements are increasing. An industrial hygiene position that has training specific to firing range/weapons safety and access to more modern sampling equipment could enhance the effectiveness of the current industrial hygiene monitoring process.

Independent Oversight observed a semi-annual specialty firearms qualification class for the M-60 machine gun and MK-46 machine gun. The classroom safety briefings were comprehensive and followed the lesson plans for this class. The students were attentive and were asked to participate in the class by reading the general safety rules for all range activities. The HIMP for firing-range activities was referenced to emphasize the current training conditions, such as cold weather, that were expected that evening. A briefing was conducted for each specific weapon by the instructors at the range before the live-fire exercise; the briefing appropriately emphasized the safety features of the weapon and reviewed the conduct of qualification training. All safety equipment, including PPE, was reviewed in the briefing and checked by the instructors. Emergency medical kits and redundant communication equipment were available at the ranges and were specified as required in the training safety documentation. The required instructor/student ratio was accurately defined in the qualification live-fire training documentation.

Summary

LASO, LANL, and PTLA security personnel are acutely aware of the importance of a strong safety interface for protective force training. PTLA safety documentation is extensive and consistent with DOE Firearms Safety Standards. LASO and LANL security specialists interact with PTLA on a daily basis and are aware of the numerous safety requirements necessary for effective and safe protective force training. Fire range instructors are experienced and are certified as required by the DOE standard. Although no specific safety deficiencies were noted during the observed activities, the LANL/PTLA concept for dedicated industrial hygiene support for protective force training environments could address the increasingly stringent requirements for industrial hygiene at live-fire ranges.

F.2.5 Nuclear Facility Safety System Oversight

Independent Oversight selected SSO as a focus area because DOE requirements in this area are relatively new and previous Independent Oversight inspection results indicate that a number of deficiencies in safety systems could be corrected and prevented by an effective SSO program. To assess this area, Independent Oversight interviewed LASO and LANL personnel, reviewed various documents and procedures, and examined training and qualifications. Independent Oversight also evaluated LANL's self-assessment of nuclear facility safety system and the cognizant system engineer (CSE) program. Independent Oversight's review of the LASO and LANL programs focused on their implementation at Technical Area (TA)-55.

Assessments

The LANL Nuclear Safety Executive Board (NSEB) provides an appropriate mechanism for ensuring that LANL management is aware of and addresses nuclear facility problems. The NSEB has a clearly defined role to strengthen LANL's safety posture by elevating nuclear safety issues to the attention of senior management and to ensure that institutional issues and their associated corrective actions are appropriately identified and closed. The extensive information presented to the Board consists of Price-Anderson Amendments Act activities, nuclear safety status (including readiness status), management assessments, Occurrence Reporting and Processing System (ORPS), safety basis issues, criticality safety, reactor safety, training and qualification, and Defense Nuclear Facilities Safety Board issues. The NSEB reviews the information and assigns actions, which generally are appropriate to address the issue. For example, several criticality deficiencies were recently identified and documented by ORPS reports from various LANL nuclear facilities. The various responsible divisions had been considering actions separately for their specific facilities, but the criticality issue was presented to the NSEB, and a consolidated path forward was formulated. The actions included requesting NNSA Headquarters to perform a thorough criticality safety review of the various nuclear facilities to determine the contributing factors and root causes for the recent deficiencies; this review was started in late October 2005.

Although an effective process, the NSEB's role is primarily to react to deficiencies identified in operations of LANL nuclear facilities. The NSEB is not responsible for ensuring that LANL performs proactive and effective assessments and reviews at LANL nuclear facilities. Although an LIR on self-assessment is in effect, the NSEB does not receive or review any assessment plans from the individual divisions responsible for nuclear safety. As a result, on an institutional level, nuclear safety assurance reviews are not systematically planned and conducted to ensure that key nuclear safety topical areas are reviewed on a regular basis.

The LIR on self-assessments assigns responsibility to the functional managers for safety basis to assess performance in the safety basis area. The safety basis functional managers track the number of technical safety requirement (TSR) violations, but otherwise they have not adequately assessed safety basis quality or performance. LANL has not provided resources to perform safety basis oversight, as evidenced by a LANL assessment of functional manager performance and Independent Oversight interviews with functional managers. Because of the LANL assessment and other feedback, LANL management is aware that functional managers are providing limited reviews of safety basis performance.

As discussed in Section 1 and Appendix D, LANL stood down operations in 2004 and performed extensive management self-assessments (MSAs) as part of its resumption effort. The MSAs included specific review criteria that focused on nuclear safety functional areas, such as training and qualification, configuration management, and authorization basis. For TA-55, several findings and significant observations were identified in the MSAs in these areas. As examples of the many significant deficiencies that the MSAs identified, the Operations Center training program did not meet the rigor required by DOE Order 5480.20A; there were no defined maintenance programs for many facility infrastructure and mission-critical systems; the Nuclear Materials Technology Division (NMT) did not have a division-wide program for configuration management; and NMT-AP-001 did not provide a mechanism for reviewing all procedure changes through the unreviewed safety question (USQ) process. TA-55 is in the process of developing a consolidated corrective action plan to address these and other known deficiencies. The process improvements primarily focus on developing documents, modifications, and process changes; scheduling and releasing work/documents; applying quality systems and requirements; implementing conduct of operations; managing performance assurance activities; and updating training and qualification. The Integrated Action Plan for TA-55 is in the early stages of design and planning.

LANL has conducted some reactive nuclear safety reviews to identify the extent of weaknesses in the USQ and TSR programs, following concerns by LASO. As discussed in the following paragraphs, LANL has identified a number of deficiencies and is managing corrective actions through the operational efficiency program (see Appendix D.2.1); however, improvements at the division and activity level have been limited and not timely.

LASO assessments and reviews have found significant problems in USQ implementation over the last several years. In 2004, the LANL sponsored a limited-scope USQ review, which was performed by external contractors and found major deficiencies in addressing interim conditions in the USQ process; these deficiencies were folded into the safety-basis operational efficiency task area, and the responsible divisions were assigned responsibility for the necessary corrective actions. During the 2004 stand-down, the USQ procedure was revised and approved, and it included the requirement to review interim conditions. As a result of continued USQ problems, a 2005 100 percent review of negative USQ determinations was performed to determine whether any should have been positive rather than negative. The results are expected to be included in lessons-learned training presented to those involved with the USQ process in the near future. Later in 2005, based on LASO's continuing to find significant deficiencies with USQ implementation, further reviews were performed that assessed all USQ processes, including applicability assessments, screenings, and USQ determinations. LASO also identified significant problems in USQ implementation at the Weapons Engineering Tritium Facility (WETF) and in response, a LANL USQ review was conducted at WETF from June to August 2005 to determine whether USQ determinations adequately addressed interim conditions (e.g., a negative USQ based on start and end condition could be actually positive when interim conditions are considered). Although corrective actions for USQ deficiencies are part of the operational efficiency safety basis task area, Independent Oversight's review of performance in TA-55 indicates that corrective actions have not been effectively developed or implemented by the divisions.

A similar concern applies to TSRs. LANL sponsored a review of TSRs in 2004 before the stand-down. The deficiencies from this review became a part of the operational efficiency safety basis task area, and corrective actions were assigned to the responsible divisions. In June 2005, a safety basis review conducted by Audit and Assessments to evaluate TSR implementation identified significant deficiencies in many of the LANL nuclear facilities; however, the responsible divisions have not yet developed corrective actions. Based on significant deficiencies in TSRs found by LASO, a reactive TSR validation review will start in the next few months to provide feedback to the operational efficiency safety basis task on TSR implementation.

The LANL LIR requires divisions, including NMT, to perform regular MSAs of its nuclear facilities. For TA-55, the MSA program is in development, and no assessments were performed in 2005.

Furthermore, in many cases, NMT system engineers did not enter corrective action processes when discrepancies were identified in their systems, and they demonstrated limited knowledge of the existence of any such processes. Independent Oversight identified numerous examples of previously known and newly found system discrepancies that were not entered into any corrective action process, and therefore were not subject to a formal process to manage, provide appropriate resources, and track their correction in a controlled manner, including the following:

- The Independent Oversight team identified the loss of safety-class pressure boundary confinement with the discovery of open bypass valves on a number of safety-class Zone 1 and Zone 2 HEPA filter plenums. In addition to not entering the PISA process, the system engineers did not enter any corrective action process for this discrepancy (and did not exhibit any understanding of the need to enter such a process), and no corrective actions were taken for almost two weeks following identification of the problem. The only actions taken were to report the problem to the plant operators. No non-conformance report, PISA, or documented extent-of-condition evaluations were initiated until they were explicitly asked about it by the Independent Oversight team.

- Safety-significant fire suppression piping above a laboratory ceiling that is not seismically supported is a longstanding, known deficiency that has not been properly addressed.

- Laboratory areas with insufficient fire suppression water pressure to meet the spray density required of an Ordinary Hazard Group 2 facility is another longstanding, known deficiency that has not been properly addressed.

TA-55 recently chartered an Issues Management Corrective Action Board to track open issues. It meets weekly to discuss new issues and to update the status of open issues. Currently, the issues listed above are not being tracked by the Board. LANL has recently issued a Vital Safety System Technical Baseline Reconciliation Plan that estimates the costs for TA-55 to develop/revise system design descriptions, drawings, and procedures.

The deficiencies discussed above reflect the broader deficiencies in assessments and corrective action management as discussed in Appendix D and Findings #12 and #13. However, they also indicated the NMT has not adequately defined and implemented an integrated approach to nuclear safety assessments and corrective actions for TA-55 that ensures assessments are coordinated and comprehensive, that deficiencies identified through assessments are evaluated and prioritized, and that resources are applied to ensure resolution in a timely manner.

Finding #25. LANL/NMT has not sufficiently defined and implemented an integrated approach to nuclear safety assessments and corrective actions that ensures that line management adequately addresses and resolves deficiencies in nuclear safety systems in a timely manner.

Cognizant System Engineering Program

LANL has made progress on developing a CSE program, which is a DOE Order 420.1A requirement. A formal CSE qualification process has been established and is supported by qualification cards that address core, position-specific, and system-specific qualifications. The courses supporting the CSE qualification cards have been developed and attended by the cadre of CSEs. A continuing training program has started to ensure that CSEs continue to learn and improve their proficiency. In addition, a list of vital safety systems has been established, and each system has been assigned to one or more CSEs. LANL has not yet conducted any CSE system assessments but is expected to start them during the second quarter of FY 2006. To date, some assessments have been performed on the post-maintenance testing process.

For the TA-55 systems reviewed by Independent Oversight during this inspection, the ventilation and fire suppression CSEs have good educational and experience backgrounds to perform the duties of a system engineer. During the review, the CSEs demonstrated that they were generally technically knowledgeable, capable, and well qualified in their respective disciplines. They have completed the three CSE qualification cards and have passed a required oral exam on their assigned systems to demonstrate completion of the necessary training on procedures and processes pertinent to their responsibilities.

In addition to corrective action management weaknesses discussed above, several other weaknesses were noted in the implementation of the CSE program at TA-55. Currently, the CSEs lack an assigned program manager. Also, they were significantly lacking in their detailed technical knowledge of their respective systems' designs, the authorization bases, and the supporting bases for these systems. This lack was attributable to several causes, including : (1) CSE training not addressing detailed, system-specific technical training, which was assumed could be absorbed on the job; (2) the difficulty in locating and obtaining many of the documents that contain details about systems; (3) the broad spectrum of responsibilities into which system engineers were thrust before they had sufficient opportunity to research such technical details; (4) management's tendency to compartmentalize responsibilities, which inhibited the system engineers from gaining in-depth understanding and ownership of the systems authorization bases; and (5) the short time that the CSEs have been assigned to these systems. TA-55 management is aware of these deficiencies and has started to review these problems with the Engineer Division, which is responsible for the CSE program. Appendix E provides more detail about the deficiencies in the systems and the supporting processes.

Finding #26. LANL has not fully instituted an effective cognizant system engineer program at TA-55 that ensures that system engineers are fully knowledgeable about the technical details/bases of their systems, including the authorization bases, interaction with supporting control systems, technical manuals, and associated system performance criteria and supporting calculations.

Summary

The nuclear safety components of the LANL contractor assurance program have been reactive and not effective or timely in driving needed corrective actions. Further, the CSE program has not been effectively implemented at TA-55: leadership positions are vacant, system-specific technical training is not provided, system engineers are not knowledgeable of the technical detail of their systems, and the compartmentalization of responsibilities that exists in the organizations has inhibited the sense of overall system ownership by the system engineers that is vital to the program's success. These are other examples of deficiencies in the overall LANL feedback and improvement program (see Appendix D) and contribute to the significant deficiencies observed in safety systems (see Appendix D).

F.3 Conclusions

LASO and LANL have devoted appropriate attention and resources to implementing the EMS and CBDPP, and these programs are generally comprehensive and effective. Similarly, LASO, LANL, and PTLA have devoted significant attention to the safety of protective force training activities and have implemented generally effective measures in this area. LANL has also established appropriate qualifications and procedures for hoisting and rigging activities, although LASO and LANL have not ensured that the contractual requirements are current and accurately flow down to the working level. Although a few implementation weaknesses warrant continued attention, LASO and LANL have devoted appropriate resources and management attention to these areas and have generally adequate programs in place. However, in the area of SSO, LANL is not effectively implementing the nuclear safety system components of its contractor assurance system, and its cognizant engineer program is not fully and effectively implemented.

F.4 Opportunities for Improvement

This Independent Oversight inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

LANL – Environmental Program

1. **Continue to develop ways to increase the effectiveness of the EMS and P2 programs**. Specific actions to consider include:

   - Establish a means for P2 staff within requesting organizations to review the Project Requirement Identification Document for new projects to determine whether there are opportunities to apply pollution prevention during the planning phase.

   - Reconsider the decision not to issue a revised ISMS description that incorporates EMS.

LASO, LANL, and PTLA

1. **LANL organizations should strive to take advantage of ES&H subject matter experts within their respective organizations and the DOE complex to enhance self-assessments, interpretation of exposure data, and instrumentation used to monitor the safety and health aspects of protective force training.** Personnel responsible for safety and health in protective force training could :

   - Occasionally utilize non-security ES&H personnel to participate in the management walk-around and self-assessment programs, as guest speakers to stimulate routine protective force training modules, or to add perspective to the HIMP process and documentation.

   - Engage LASO and LANL ES&H/subject matter experts to assist in an evaluation of the PTLA/industrial hygiene monitoring program to include a review of instrumentation used by HSR-5, the need for a deployed industrial hygiene support person, and a review of recent methodology used to measure pulse and impact noise associated with firearms and explosive devices used in protective force training exercises.

LANL - CBDPP

1. **Consider a sampling strategy that includes machine shop equipment, such as mills, lathes, and grinding and sanding machinery, that is located in division machine shops throughout the LANL complex and that was not included in the legacy beryllium monitoring program.**

LASO and LANL – Hoisting and Rigging

1. **Consider establishing LASO and LANL process "owners" to ensure that current DOE requirements are reflected in contracts, LANL requirements documents are accurate, and requirements flow down correctly to activity-level procedures and training materials.**

LANL – Contractor Assurance System for Nuclear Safety Systems

1. **Consider expanding the role of the NSEB to include reviewing institutional and divisional nuclear safety oversight plans and assessment results.**

2. **Consider expanding the role of the program manager for safety basis to establish and implement an institutional nuclear safety assessment program.**

3. **Consider chartering the Audit and Assessment Division to conduct a review of the nuclear facility management self-assessment programs. Following completion of the review, develop and implement corrective actions as required to improve the division-level management self-assessment programs.**

4. **Ensure that corrective action management processes are understood and used.** Specific actions to consider include:

   - Conduct training for all technical personnel in the facility on the established corrective action process.

   - Enter all discrepancies identified during this assessment and resulting from the activities performed for the previous recommendation into the process.

   - Continue to use this process as required for identifying corrective actions, assigning responsibilities, and tracking, resolving, and managing corrective actions in the facility.

LANL - CSE

1. **For each assigned CSE, consider performing a self-assessment of the current conditions of the system with respect to configuration management, implementation of codes and standards, authorization basis requirements and supporting calculations, maintenance procedures, surveillance and testing**

procedures, procurement, system design descriptions, and other system requirements. Based on the results, establish a gap analysis and develop an improvement plan with appropriate milestones to be implemented by the assigned CSE and with additional staff as necessary.

2. **Consider revising the system-specific qualification process to implement the needed improvements that were identified by LANL.**

3. **Consider establishing regular meetings between the facility CSEs and the Safety Basis Group to discuss recent changes to the authorization basis based on USQs, results of TSR surveillance and testing, etc.**

Abbreviations Used in This Report (Continued)

C-SIC	C-Division Actinide, Catalysis and Separations Chemistry
CY	Calendar Year
DARHT	Dual-Axis Radiographic Hydrodynamic Test Facility
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
dp	Differential Pressure
DSA	Documented Safety Analysis
DX	Dynamic Experimentation
EMS	Environmental Management System
ES&H	Environment, Safety, and Health
ESF	Essential System Functionality
ESH	LANL Environment, Safety, and Health Division
FCS	Facility Control System
FHA	Fire Hazards Analysis
FIRP	Facility Infrastructure Revitalization Program
FMD	Facility Management Division
FSAR	Final Safety Analysis Report
FTE	Full-Time Equivalent
FY	Fiscal Year
HCP	Hazard Control Plan
HEPA	High Efficiency Particulate Air
HIMP	Hazard Identification and Mitigation Plan
HSR	Health, Safety and Radiation Protection Division
HVAC	Heating, Ventilation, and Air Conditioning
IAB	Institutional Assurance Board
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
ISO	International Organization for Standardization
IWD	Integrated Work Document
IWM	Integrated Work Management
IWMC	Integrated Work Management Committee
JHA	Job Hazards Analysis
JON	Judgment of Need
LANL	Los Alamos National Laboratory
LANSCE	Los Alamos Neutron Scattering Science Center
LASO	Los Alamos Site Office
LCAP	Local Corrective Action Plan
LIG	Laboratory Implementation Guide
LIR	Laboratory Implementation Requirement
LPR	Laboratory Performance Requirement
LRR	Laboratory Readiness Review
ML	Management Level
MRDP	Medical Radioisotope Development Procedure
MSA	Management Self-Assessment
MSDS	Material Safety Data Sheet

(Continued on inside back cover)

Abbreviations Used in This Report (Continued)

MSWA	Management Safety Walk-Around
NFPA	National Fire Protection Association
NMT	Nuclear Materials Technology
NNSA	National Nuclear Security Administration
NSEB	Nuclear Safety Executive Board
OJT	On-the-Job Training
OSHA	Occupational Safety and Health Administration
ORPS	Occurrence Reporting and Processing System
P2	Pollution Prevention
PAAA	Price-Anderson Amendments Act
PHA	Preliminary Hazards Assessment
PIC	Person in Charge
PISA	Potentially Inadequate Safety Analysis
PPE	Personal Protective Equipment
PTLA	Protection Technology Los Alamos, Inc.
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RDL	Responsible Division Leader
RLM	Responsible Line Manager
RTBF	Readiness in Technical Baseline Facilities
RWP	Radiation Work Permit
SME	Subject Matter Expert
SOP	Standard Operating Procedure
SPOC	Space Point of Contact
SSC	Structures, Systems, and Components
SSO	Safety System Oversight
TA	Technical Area
TCE	Trichloroethylene
TLV	Threshold Limit Value
TRC	Total Recordable Case
TSR	Technical Safety Requirement
UC	University of California
UL	Underwriters Laboratory
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
WBS	Work Breakdown Structure
w.c.	Water Column
WETF	Weapons Engineering Tritium Facility