Volume I

Inspection of Environment, Safety, and Health Management at the

Los Alamos National Laboratory

April 2002

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

INDEPENDENT OVERSIGHT
INSPECTION OF
ENVIRONMENT, SAFETY, AND HEALTH MANAGEMENT
AT THE
LOS ALAMOS NATIONAL LABORATORY

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ACRONYMS

AAAHC	Accreditation Association for Ambulatory Health Care
AHA	Activity Hazard Analysis
AL	Albuquerque Operations Office
ALARA	As Low As Reasonably Achievable
BAT	Best Available Technology
BIO	Basis for Interim Operation
CAAC	Chemistry – Actinide Analytical Chemistry
CAM	Continuous Air Monitor
CFR	Code of Federal Regulations
CMR	Chemistry and Metallurgy Research
CY	Calendar Year
DCG	Derived Concentration Guideline
DOE	U.S. Department of Energy
DP	Office of Defense Programs
ES&H	Environment, Safety and Health
ESH	LANL Environment, Safety, and Health Division
ESH-ID	ES&H Hazard Identification
F&IB	Feedback and Improvement Board
FMU	Facility Management Unit
FR	Facility Representative
FRAM	Functions, Responsibilities, and Authorities Manual
FWO	Facility and Waste Operations
FY	Fiscal Year
GWPMP	Groundwater Protection Management Program Plan
HCP	Hazard Control Plan
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation, and Air Conditioning
ISM	Integrated Safety Management
ISO	International Standards Organization
ITSR	Interim Technical Safety Requirement
JCNNM	Johnson Controls of Northern New Mexico
LANL	Los Alamos National Laboratory
LIG	Laboratory Implementing Guide
LIR	Laboratory Implementing Requirement
LPR	Laboratory Performance Requirement
M&TE	Measuring and Test Equipment
MEL	Master Equipment List
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NMED	New Mexico Environmental Department
NMT	Nuclear Materials Technology
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
OA	Office of Independent Oversight and Performance Assurance
OFO	Office of Facility Operations
OLASO	Office of Los Alamos Site Operations
ORPS	Occurrence Reporting and Processing System

ACRONYMS (Continued)

OST	Operations Support Tool
POD	Plan of the Day
PPE	Personal Protective Equipment
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RLWTF	Radioactive Liquid Waste Treatment Facility
RTBF	Readiness in Technical Base and Facilities
RWP	Radiation Work Permit
SAR	Safety Analysis Report
SDD	System Design Description
SD-HCP	Short-Duration Hazard Control Plan
SOC	Skill of the Craft
TA	Technical Area
TQP	Technical Qualification Program
TR	Safety and Health Technical Representative
TSR	Technical Safety Requirement
TWA	Time Weighted Average
TYCSP	Ten Year Comprehensive Site Plan
UC	University of California
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
WAC	Waste Acceptance Criteria
WFM	Waste Facility Management

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1.0 INTRODUCTION

The Secretary of Energy's Office of Independent Oversight and Performance Assurance (OA) conducted an inspection of environment, safety, and health (ES&H) programs and emergency management programs at the U.S. Department of Energy (DOE) Los Alamos National Laboratory (LANL) in March-April 2002. The inspection was performed as a joint effort by the OA Office of Environment, Safety and Health Evaluations and the Office of Emergency Management Oversight. This volume discusses the results of the review of LANL ES&H programs. The results of the review of the LANL emergency management programs are discussed in Volume II of this report and the combined results are discussed in a summary report.

The DOE National Nuclear Security Administration (NNSA) has DOE Headquarters responsibility for programmatic direction and funding of activities at LANL. Within the NNSA, the Albuquerque Operations Office (AL) and its subordinate Los Alamos Area Office historically had line management responsibility for operational direction and DOE line management oversight at LANL. In accordance with the changes in line management directed by the NNSA Administrator in March 2002, the Los Alamos Area Office has been renamed as the Office of Los Alamos Site Operations (OLASO), was made a direct report to the NNSA Administrator, and will be given increased responsibility and accountability for managing and directing the LANL contractor. Concurrently, AL will transition to a support office for OLASO and other NNSA site operations offices. Under contract to AL, the University of California (UC) is the prime contractor for operations at LANL. Transition of contractual administration to OLASO is planned.

Throughout its evaluation of ES&H programs, OA reviews the role of DOE organizations in providing direction to contractors and conducting line management oversight of the contractor activities. OA is placing more emphasis on the review of contractor self-assessments and DOE line management oversight in ensuring effective ES&H programs. In reviewing DOE line management oversight, OA focused on the effectiveness of NNSA, AL and OLASO in managing the LANL contractor, including such management functions as setting expectations, providing implementation guidance, allocating resources, monitoring and assessing contractor performance, and monitoring/evaluating contractor self-assessments. Similarly, OA focuses on the effectiveness of contractor self-assessment programs, which DOE expects to provide comprehensive reviews of performance in all aspects of ES&H.

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 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 the ES&H portion of this inspection was to assess the effectiveness of selected aspects of ES&H management as implemented by LANL under the direction of NNSA, AL, and OLASO. The OA inspection team used a selective sampling approach to determine the effectiveness of NNSA, AL, OLASO, and LANL in implementing DOE requirements and expectations. This approach involves examining selected institutional programs that support the integrated safety management (ISM) program, such as OLASO and LANL assessment programs and programs for identifying and implementing applicable requirements. To determine the effectiveness of the institutional programs, the OA team examined the implementation of requirements by LANL and its subcontractors at two selected LANL facilities.

The two selected facilities were the Chemistry and Metallurgy Research (CMR) facility and the Technical Area (TA)-50 Radioactive Liquid Waste Treatment Facility (RLWTF). CMR supports programmatic and research and development and laboratory operations related to chemistry and metallurgy of materials, including plutonium, uranium, and other radioactive materials. The CMR facility is managed by the Nuclear Materials Technology organization. Various other LANL organizational elements perform activities at CMR under facility-tenant agreements. The RLWTF supports processing of radioactive liquid wastes generated at various LANL laboratories and facilities (e.g., wastewater from chemical processing of radioactive materials) and management of the associated waste materials. It is managed by the Facility and Waste Operations Division and is located at TA-50. CMR and RLWTF were selected because they support a wide range of programmatic work (which includes research and development and ongoing programmatic activities, such as laboratory testing of nuclear materials and components) and facility operations and maintenance activities. The approach also allows the evaluation of several different LANL organizational elements that perform work at CMR and/or RLWTF.

The ES&H portion of the inspection was organized to evaluate five related aspects of the ISM program:

- Implementation of the guiding principles of ISM
- OLASO and LANL continuous improvement and feedback systems
- Implementation of the core functions of safety management to work activities (programmatic work and maintenance) at CMR and RLWTF
- The functionality of selected essential systems at the CMR facility (i.e., fire protection and heating, ventilation, and air conditioning systems) using an approach consistent with the intent of the DOE Implementation Plan for Defense Nuclear Facilities Safety Board Recommendation 2000-2
- OLASO and LANL implementation of environmental protection programs at the LANL site, with primary emphasis on the CMR and RLWTF facilities. The review encompassed the application of the core functions of ISM to environmental monitoring, waste management, and environmental radiological controls.

As discussed in this report, many aspects of ISM are effectively implemented at LANL and significant progress has been enhancing ES&H programs and performance. However, weaknesses are evident in several areas including operational procedures, hazards analysis and control, and configuration management. Also, current weaknesses in OLASO and LANL feedback and continuous improvement assessments systems hinder the ability to achieve the needed improvements.

Section 2 of this volume provides an overall discussion of the results of the review of the LANL ISM program, including positive aspects, findings, and other items requiring management attention. Section 3 provides OA's conclusions regarding the overall effectiveness of OLASO and LANL management of the ES&H programs. Section 4 presents the ratings assigned as a result of this review. Appendix A provides supplemental information, including team member composition. Appendix B identifies the specific findings that require corrective actions and follow-up. Appendix C presents the results of the review of the guiding principles of ISM. Appendix D presents the results of the review of the AL/OLASO and LANL feedback and continuous improvement processes. The results of the review of the application of the core functions of ISM at CMR and RLWTF are discussed in Appendix E. Appendix F discusses the results of the review of the functionality of essential systems at CMR. The results of the review of environmental protection systems are discussed in Appendix G.

2.0 STATUS AND RESULTS

The results of this review indicate that ISM at LANL has several significant positive attributes (see Section 2.1). OLASO and LANL have established an appropriate ISM framework and many elements of the program are effectively implemented. However, several weaknesses and areas requiring attention were identified (see Section 2.2).

2.1 Positive Program Attributes

The leadership and direction of NNSA, DP, AL, and OLASO have resulted in improvements in ISM at LANL. The DOE line organizations have been instrumental in driving improvements in LANL ISM. With a few exceptions in the environmental protection area, DOE line management — NNSA, the Office of Defense Programs (DP), AL, and OLASO — has worked effectively with LANL to establish clear ES&H policies and performance expectations for LANL in the DOE/UC contract. The contract includes a work smart standards that identifies an appropriate set of requirements and performance expectations, including performance goals such as for zero injuries, illnesses, and environmental incidents. DOE line management used the latest DOE/UC contract negotiation process (signed in December 2000) to introduce a new set of performance initiatives designed to ensure that LANL improves safety performance in key areas such as nuclear facility operations, authorization basis, and project management. For example, the contract mandates a rigorous assessment of LANL operations; the assessment was performed by an external organization and resulted in significant findings that are producing numerous corrective actions and improvements in ISM at LANL. AL and OLASO have continued to use contract modifications as a vehicle to drive improvements at LANL. The need for increased formality of operations was recognized and is being addressed by including the DOE conduct of operations order in the contract in March 2001. The NNSA reengineering initiative, and the transfer of the contract administration and evaluation function to OLASO, is another important step in the ongoing effort to empower the NNSA field elements to perform effective line management and line oversight of their contractors.

LANL senior management has provided sustained leadership that has resulted in implementation of ISM at LANL. Although deficiencies remain and much work remains to be accomplished (e.g., improved formality of operations), LANL has successfully completed the ISM verification process. The transition to ISM from the historical "expert based" approach to safety, which relied heavily on the experience and initiative of individuals to recognize and control hazards, has been challenging and has required sustained commitment by the senior management team to achieve acceptance at the lower tiers of management. Currently, support for ISM has filtered down to lower tiers of management—division managers, facility managers and group leaders—and ISM is widely accepted by the LANL and Johnson Controls of Northern New Mexico (JCNNM) workforce, including maintenance personnel, facility operators, laboratory personnel, scientists, and engineers. Interviews with LANL management and workers indicated that ISM goals and objectives for integrating safety in all aspects of work are well understood and accepted. ISM implementation has resulted in dramatic improvements in the approach to safety management at all levels of the LANL organization. In the past five years, LANL has established an effective requirements management system, formal systems for integrating ES&H needs into project planning and resource allocation, mechanisms for holding organizations and individuals accountable for ES&H performance, and integrated work planning processes that effectively identify hazards and establish controls before work is authorized. In addition, ES&H performance, as indicated by the performance metrics, has been steadily improving as the benefits of ISM and the focus on performance measure are realized. A key to success has been sustained management commitment to a top-down approach in which they first focused on establishing the top-tier policies and then on the institutional programs and requirements, division-level implementing procedures, facility-level procedures, and finally work instructions. Continued management attention and commitment will be needed to ensure that the remaining efforts to establish work instructions for all potentially hazardous operations (e.g., operating procedures for safety-related equipment) are effective and timely.

Several aspects of LANL's ISM program are particularly effective or innovative in the area of worker protection. In general, the performance measure trends indicate improvements in ES&H in recent years, and LANL injury and illness rates are low compared to similar industries and other DOE laboratories. LANL and JCNNM personnel were, for the most part, very qualified and motivated, and they demonstrated good understanding of the hazards and facility operations. Various processes for involving and empowering the workforce are established and effective. Workers are empowered to stop work if an unsafe condition is identified, and they are not hesitant to invoke their stop-work authority. LANL has initiated a number of innovative concepts for empowering workers and promoting safe work behaviors such as the nested safety committees and a program that entails workers observing other workers during the performance of work to identify potential "at risk" behaviors and promote awareness of safety. The LANL program for disseminating lessons learned includes innovative techniques, such as linking lessons learned to procedures and permits. Various efforts to reduce and control hazards are ongoing, such as the CMR efforts to control and reduce chemical inventories and the extensive RLWTF effort to address legacy problems by updating and certifying electrical drawings. Engineering controls are used extensively and are effectively implemented to reduce risks to workers. RLWTF has developed a strategy for operations procedure development that integrates controls resulting from the hazard control plan (HCP) directly into the procedures. The controls are placed in cautions, warnings, or action steps directly associated with the activity steps where the hazards are encountered. This application of the requirements for safe work practices to operational activities and the approach to operational hazard control are noteworthy in that safety is fully integrated into the instructions used by the operators to perform work.

Radiological environmental monitoring and surveillance activities at LANL have been effectively implemented, and some aspects are noteworthy. The air, water, and ecology groups within LANL's Environment, Safety and Health division (ESH) conduct routine annual environmental surveillance of all potentially affected environmental media. The air program monitors stack effluents and ambient air using a network of stationary air samplers situated around the site. Routine sampling of surface water and sediment in representative areas that may be impacted by current operations or legacy sources and surveillance of remaining media that may be impacted, such as soil, foodstuffs, and biota, are being performed consistent with applicable requirements. Results of monitoring and surveillance are compiled by the respective groups and published annually in the environmental surveillance reports. The radiological sections of these reports, including public dose assessments, were well organized, thorough, and comprehensive. Certain aspects of the radiological environmental monitoring and surveillance program are noteworthy. Specifically, the bases for the design and implementation of the air monitoring systems (i.e., data quality objectives, analytical methods, sensitivities, and quality assurance) are of high quality. Also, the ability of the radiological environmental monitoring systems to distinguish site-derived radionuclides from natural background and determine the impacts from all media is superior to those seen at most other DOE sites, particularly for the ambient air monitoring network. These systems provide assurance that even small releases of radionuclides would be detected, thereby enhancing protection of the public and the environment.

LANL has established a comprehensive program for the identification and analysis of beryllium contamination. The beryllium program addresses both current and legacy uses and is being rigorously implemented at CMR. The extensive characterization of the beryllium hazard at CMR included development of a beryllium sampling strategy, collection of more than 300 surface and air samples, extensive interviews with current and former LANL workers who may have been exposed to beryllium, and a risk-based plan for future sampling and decontamination of beryllium contaminated areas.

The LANL occupational medical program has achieved re-accreditation. The LANL occupational medical program successfully completed a second three-year term of accreditation from the Accreditation Association for Ambulatory Health Care (AAAHC). The AAAHC accreditation process is a voluntary activity that benchmarks the clinical application of occupational health services with nationally recognized standards maintained by the AAAHC organization. The LANL occupational medical program was found to comply with all AAAHC standards reviewed in the February 2002 AAAHC survey. In addition, the LANL occupational medical group has maintained and expanded several institutional initiatives, such as the tri-laboratory peer review process, the medical/industrial hygiene interface agreement, and most recently participation in the medical section of the Energy Facilities Contractor Group. Occupational medical program requirements are clearly identified in institutional requirements. In addition, the medical director is planning to initiate a specific occupational medical program Laboratory Implementing Requirement (LIR) that will further clarify line management responsibilities to inform ESH-2 of health hazards and provide a more efficient vehicle for managers and employees to participate in occupational medical surveillance programs.

2.2 Program Weaknesses

LANL facilities do not have adequate procedures for some equipment and operations, and LANL management has not yet emphasized use of and adherence to procedures as an important element of ISM. CMR currently does not have adequate procedures for operation of some safety systems and safety-related equipment and thus cannot adequately assure that systems and equipment are always configured correctly and operated in accordance with ISM and conduct of operations requirements. RLWTF management has not yet established and sufficiently enforced clear expectations for the use of procedures for facility operations. Some operating procedures have not yet been developed; many existing operating procedures are of poor quality or are not current; and operating procedures are often not used or followed in the RLWTF. CMR and RLWTF are both in the process of developing operating procedures; however, progress has been slow at RLWTF, and CMR is in the early stages. At the institutional level, LANL is in the planning stage of implementing the DOE conduct of operations order at its facilities. Full and effective implementation of this order is an appropriate method for addressing LANL-wide weaknesses related to adequacy of procedures and adherence to procedures. However, sustained management attention is needed to implement the formality of operations required by the conduct of operations order.

The implementation of hazard identification, analysis, and control processes for programmatic work is deficient in several areas. Programmatic work (e.g., research or facility operations) at LANL is performed under the "safe work practices" process, which has many effective aspects. However, some hazards and associated controls were not identified or analyzed in the implementation of safe work practices, because sufficient tools and guidance have not been provided to line management. For example, the risk ranking of hazards has not ensured that safety and health subject matter experts are appropriately involved in the planning of programmatic work. Safety and health requirements in LIRs have not been adequately incorporated into HCPs and work instructions. Although the LANL ES&H hazard identification process has the potential to assist line managers in identifying safety requirements and hazard controls, the process has not been effectively used for programmatic work. In addition, hazard controls were not always sufficient to address the hazard because of weaknesses in HCPs, work instructions, specification of personal protective equipment, guidance for posting hazards and controls on laboratory doors, radiation work permits, and some radiation contamination workplace indicators. While work observed by the OA team at LANL was performed safely, timely attention is needed to address a number of process and implementation deficiencies in the performance of programmatic work.

Important elements of an effective configuration management program are missing or inadequate at CMR and RLWTF. The CMR configuration management program has improved but still is missing some of the fundamental program elements needed to ensure that safety systems and safety-related equipment are properly configured and will function as intended in routine and emergency conditions. Deficiencies were identified in important elements of the CMR configuration management systems and practices, including the design change process, equipment identification and tagging, review and comment resolution processes, and root cause and corrective action programs. When viewed collectively, the deficiencies above indicate a weakness in the overall configuration management program at CMR. At RLWTF, the work control process does not provide sufficient detailed requirements to ensure that appropriate documents, drawings, and procedures are updated for facility modification performed under a maintenance work package. In addition, responsibility for configuration control is not clearly defined. Both facilities have ongoing initiatives to improve configuration management.

There are deficiencies in a few aspects of the authorization basis and technical bases for a safety class fire protection system at CMR. Most aspects of CMR authorization basis documents are adequate, accurate, and complete. However, the accident analysis in the basis for interim operation does not address the threat of wildland fire or its potential effect on the TA-3 water supply. The standpipes do not have sufficient flow capacity to meet the expectations of the Los Alamos Fire Department. In addition, the risks associated with water hammer events, which are the probable cause of a safety class component failure in 1997, have not been adequately analyzed and addressed.

A few important gaps exist in an otherwise effective environmental protection system. Most aspects of LANL's environmental protection system are effective, and some aspects are significant strengths. However, there are three aspects that do not fully meet DOE expectations. First, vulnerabilities associated with potential contaminant release pathways from operational facilities to the environment have not been fully analyzed. LANL recognizes that several tanks and piping systems located at CMR and RLWTF are vulnerable to potential leaks because of aging and design weaknesses. For example, CMR has four long-unused storage tanks containing 12,000 to 15,000 gallons of water contaminated by radiation. LANL has not performed comprehensive vulnerability assessments for facilities and tank systems that would identify potential contaminant release pathways and does not have the capability to detect leaks in a timely manner as required by DOE. Second, environmental as-low-as-reasonably-achievable (ALARA) requirements of a DOE order have not been formally incorporated into site environmental processes at LANL that generate and discharge radioactive liquids to the environment. At RLWTF, LANL is releasing radioactive liquids at or below derived concentration guideline screening levels without sufficient analysis of ALARA requirements as specified in the DOE order. Third, LANL soil posting criteria and implementation guidance for environmental contamination have not been sufficient to ensure that existing soil contamination areas around the site are appropriately identified and controlled in accordance with LANL site radiation protection requirements and expectations. LANL management is in the process of addressing many of these concerns and is strengthening its institutional environmental protection functions through development of an environmental protection program plan and a reorganization that consolidates various environmental protection functions within the laboratory.

OLASO and LANL feedback and improvement programs are not fully effective in ensuring that ISM process and performance deficiencies are identified, resolved, and corrected in a timely manner. Although the framework for an effective program is in place, several weaknesses are limiting the effectiveness of the OLASO oversight of LANL ISM performance. Specifically, many planned OLASO assessments are not conducted, deficiencies in LANL ISM processes and performance identified by OLASO line oversight programs are not consistently documented and transmitted to LANL for resolution, and OLASO issue management processes do not ensure that identified deficiencies are tracked to resolution and analyzed to identify systemic problems and/or trends. LANL has numerous feedback mechanisms and performs many assessment activities but their overall effectiveness is limited by several process and implementation weaknesses. For example, many LANL assessments are not rigorous enough to identify ISM process and performance weaknesses. In addition, the LANL issues management system is not being managed in a structured, consistent, risk-based, and effective manner that supports continuous improvement.

3.0 CONCLUSIONS

OLASO and LANL have worked cooperatively to establish a comprehensive ISM program. NNSA, AL, and OLASO have provided clear direction and set ES&H performance expectations for LANL. Over, the past two years, AL and OLASO have been effective in using the DOE/UC contract to set expectations and drive improvements. OLASO and LANL have also worked cooperatively to establish a work smart standards set that appropriately addresses the hazards and conditions at LANL. NNSA, AL, and OLASO have provided programmatic direction, performance expectations, and resource allocations that reflect an appropriate balance between ES&H needs and mission needs. Appropriate ISM institutional policies and requirements have been established and communicated. Workers and stakeholders have multiple avenues to express ES&H concerns. OLASO and LANL roles and responsibilities are adequately defined at all levels of the organization. OLASO and LANL personnel exhibited a good understanding of facility hazards.

With the support of NNSA and AL, OLASO has been working the past several years to address staffing and qualification shortages and attrition. OLASO's need for additional technically qualified personnel has increased significantly in the past few years as OLASO has assumed additional line management responsibilities, such as approval of the authorization basis and starting projects. OLASO has made significant progress to obtain sufficient staff to perform its expanded role. Over the last three years, authorized technical staffing has been substantially increased (from 43 to 67) and onboard technical staff has more than doubled (from 24 to 57). During this time, the number of Facility Representatives has also increased from 6 to 18. The Facility Representative training and qualification program is effective, and the individual Facility Representatives have made good progress in completing qualification requirements. Senior NNSA and AL management commitment and support were instrumental to this progress. For example, in an effort to reduce turnover, OLASO was authorized to award retention and relocation bonuses and promote Facility Representatives to the GS-14 level once fully qualified. While OLASO has significantly increased its technical staffing, continued management attention is needed to fill 10 remaining technical staff vacancies and to ensure that OLASO has the proper skill mix to perform the expanded role envisioned by the NNSA reengineering effort. In addition, OLASO needs to ensure that its technical personnel achieve the appropriate level of technical qualifications in a timely manner. NNSA involvement and support may be necessary to address obstacles, such as the current hiring freeze, that could hinder OLASO's ability to obtain the necessary number of qualified technical specialists to perform its line oversight mission.

Some aspects of OLASO and LANL implementation of ISM are notable. LANL has established innovative methods to disseminate lessons learned, including linking them to procedures. LANL is also developing operating procedures that include the hazard controls within the operating steps. The technical basis for radiological monitoring and surveillance is noteworthy. Several efforts to control and reduce hazards, such as beryllium, have been effectively implemented. The LANL occupational medicine program has achieved accreditation.

Many aspects of the ISM program are effectively implemented at LANL. Most aspects of environmental protection programs are effective and have been successfully integrated into ISM. The LANL work control processes—which are the key processes for identifying hazards and establishing controls—are well defined and were effectively implemented. Although these processes had some weaknesses that warrant attention, they have significant strengths and are a major improvement over historical LANL practices. Work is generally well defined, pre-job briefings and job walkdowns are thorough and effective, and briefings and walkdowns appropriately involve line management, subject matter experts, and workers. Workers are involved in the work planning process and have been empowered to identify and stop unsafe work.

The most important safety systems and components at CMR were adequately maintained and were operated within the technical specifications. Most aspects of the CMR authorization basis documents are adequate, accurate, and complete. However, there are deficiencies in a few aspects of the authorization basis and technical bases for a safety class fire protection system at CMR. In addition, important elements of an effective configuration management program are missing or inadequate at CMR.

Further, although CMR and RLWTF have many well-documented safety processes and procedures that govern work and provide assurance that hazards are controlled, both CMR and RLWTF lack sufficient procedures for certain operational activities, such as operation of safety equipment. Lack of adequate procedures for many specific work activities is a LANL-wide problem. LANL management recognizes that procedures and procedural compliance requires attention and has a number of appropriate ongoing initiatives such as implementation of the conduct of operations program and various ongoing procedure development efforts. However, at the facility level, LANL management has not yet emphasized use of and adherence to procedures as an important element of ISM, and procedure development has not been a high priority or timely in some instances. Full and effective implementation of conduct of operations requirements will be a major undertaking that will require sustained management attention, particularly at the facility manager and group leader level.

Although the ISM framework is in place and improving, several process and implementation deficiencies were identified by the OA reviews. Programmatic work performed under safe work practices has many effective aspects but some hazards were not identified or analyzed in the implementation of safe work practices, because sufficient tools and guidance have not been provided to line management. As a result, some hazard controls were not identified in HCPs or work instructions, or adequately implemented (e.g., hazard postings on laboratory doors). Further, some aspects of environmental protection do not meet all DOE expectations for analysis of leak pathways, environmental ALARA, waste minimization, and soil posting.

The continuous feedback and improvement programs at OLASO and LANL have improved significantly and include numerous assessment activities, some of which have been of high quality. However, there are weaknesses in both OLASO and LANL feedback and improvement, including lack of rigor in self-assessments and a lack of rigor and comprehensiveness in issues management systems. However, OLASO and LANL feedback and improvement systems have self-identified numerous areas for improvement and have resulted in significant improvements at LANL.

Overall, OLASO and LANL have made significant improvements in ES&H and established the framework for an effective ISM program. NNSA, OLASO, and LANL have provided leadership and devoted resources to ES&H programs and ISM. Work observed by the OA team was performed with a high regard for safety and environmental protection. However, some important ISM elements, such as adequacy of procedures, procedure compliance, configuration management, and isolated aspects of hazard identification and control, are not yet sufficiently effective and mature. Weaknesses in supporting ISM systems, such as OLASO assessments, LANL assessments, and issues management, contribute to the observed implementation deficiencies and recurring weaknesses. OLASO and LANL have a good understanding of most of the weaknesses and have ongoing actions to address some of them. Continued and increased attention is needed to ensure that ongoing and planned initiatives are effectively completed in a timely manner.

4.0 RATINGS

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

Safety Management System Ratings

Guiding Principle #1 – Line Management Responsibility for Safety........ EFFECTIVE PERFORMANCE
Guiding Principle #2 – Clear Roles and Responsibilities .... EFFECTIVE PERFORMANCE
Guiding Principle #3 – Competence Commensurate with Responsibility. EFFECTIVE PERFORMANCE
Guiding Principle #4 – Balanced Priorities... EFFECTIVE PERFORMANCE
Guiding Principle #5 – Identification of Standards and Requirements...... EFFECTIVE PERFORMANCE

Feedback and Improvement

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

LANL Programmatic Work Activities and Facility Operations and Maintenance Work Activities

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

Environmental Protection

Environmental Protection (Core Functions 1-4) .... EFFECTIVE PERFORMANCE

Essential Systems Functionality

Engineering and Configuration Management.. NEEDS IMPROVEMENT
Maintenance.. EFFECTIVE PERFORMANCE
Surveillance and Testing .... EFFECTIVE PERFORMANCE
Operations... NEEDS IMPROVEMENT

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APPENDIX A

Supplemental Information

A.1 Dates of Review

	Beginning	Ending
Planning Meeting (Germantown)	March 11, 2002	March 15, 2002
Onsite Evaluation	March 18, 2002	March 28, 2002
Report Validation and Closeout	April 9, 2002	April 11, 2002

A.2 Review Team Composition

A.2.1 Management

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

A.2.2 Quality Review Board

Michael Kilpatrick
Charles Lewis
Robert Nelson
Patricia Worthington
Dean Hickman

A.2.3 Review Team

Patricia Worthington, Team Leader

Safety Management Systems
Ali Ghovanlou, Topic Leader
Tim Martin
Bernie Kokenge
Al Gibson
Robert Compton (Feedback and Improvement)

Environmental Protection
Bill Eckroade, Topic Leader
Vic Crawford
Mario Vigliani
Tom Naymik

Technical Team
Bob Freeman, Topic Leader

CMR Core Function Implementation
Jim Lockridge
Marvin Mielke
Joe Lischinsky
Edward Stafford
Jack Riley
Mike Gilroy

Essential System Functionality
Bill Miller
Don Prevatte
Joe Panchison

A.2.4 Administrative Support

MaryAnne Sirk
Tom Davis

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APPENDIX B

Site-Specific Findings

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

FINDING STATEMENT	REFER TO PAGES:
Because of staff shortages and personnel who have not completed their technical qualification standards, the Office of Los Alamos Site Operations (OLASO) does not have sufficient technically qualified personnel to appropriately perform all assigned safety management responsibilities.	22
The Albuquerque Operations Office (AL) and OLASO have not established and implemented a fully effective and efficient oversight and self-assessment program that ensures that Los Alamos National Laboratory (LANL) and OLASO are implementing integrated safety management (ISM) as specified in DOE Policy 450.5, *Line Environment, Safety and Health Oversight.*	37
LANL feedback and improvement mechanisms, particularly assessments and issues management, have not been fully developed and rigorously implemented to identify and effectively resolve ISM program and performance deficiencies and drive continuous improvement as specified in DOE Policy 450.4, *Safety Management System Policy*, and DOE Policy 450.5, *Line Environment, Safety and Health Oversight.*	40
Baseline hazard surveys are not being maintained, and exposure assessments for chemical and physical hazards are not being performed as required by DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, to ensure that potential worker health risks are identified and evaluated.	52
The safe work practices process does not provide sufficient guidance to programmatic line managers to ensure that hazard identification tools are appropriately and consistently used. Examples of such tools include risk ranking of programmatic work activities, incorporation of safety and health Laboratory Implementing Requirements (LIRs) into hazard control plans (HCPs) and work instructions, involvement of safety and health subject matter experts, and use of the LANL environment, safety, and health hazard identification process.	54
The Chemistry and Metallurgy Research (CMR) facility does not have adequate procedures for operation of many safety systems and safety-related equipment and thus cannot adequately assure that systems and equipment are always configured correctly and operated in accordance with ISM and conduct of operations requirements. Furthermore, Radioactive Liquid Waste Treatment Facility (RLWTF) management has not yet established and sufficiently enforced clear expectations for the development and use of procedures for facility operations. Many procedures have not yet been developed, most existing procedures are of poor quality or are not current, and procedures are often not used or followed in the RLWTF.	56

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

The work control process at RLWTF does not ensure that appropriate documents, drawings, and procedures are updated for facility modifications performed under a maintenance work package.	57
For programmatic work, hazard controls are not sufficiently defined or adequately implemented in several areas: controls in HCPs and work instructions lack the level of detail to ensure effective implementation and are often inconsistent with similar controls specified in LIRs; personal protective equipment is not clearly specified for some hazards; aggregate hazards in laboratories are not communicated to workers (e.g., door postings); some radiation work permits are not adequately tailored for the work activity; and some radiation contamination workplace indicators are not adequately considered.	60
The CMR accident analysis in the basis for interim operation does not address the threat of wildland fire or its potential effect on the Technical Area (TA)-3 water supply.	68
LANL has not identified as a concern or formally mitigated the effects of water hammer events in the TA-3 water system that repeatedly challenge and reduce the reliability of the CMR safety-class fire suppression system.	71
LANL has not adequately and promptly addressed significant previously recognized discrepancies with fire protection, including those documented in the emergency management and fire protection assessment (August 2001) and in the 1998 CMR fire hazards analysis report.	72
The standpipes at CMR, as installed, are undersized and will not pass the National Fire Protection Association code flow requirements and Los Alamos Fire Department expectations; the Los Alamos Fire Department was unaware of the standpipe limitation.	72
Current configuration management systems and practices do not contain some essential elements, including a fully effective design change process, completion of equipment identification and tagging on several important systems, a formal review and comment process, and a fully mature root cause and corrective action program.	73
Vulnerabilities associated with potential contaminant release pathways from operational facilities to the environment have not been fully analyzed.	85
Environmental as-low-as-reasonably-achievable (ALARA) requirements of DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, have not been formally incorporated into site environmental processes at RLWTF and CMR that generate and discharge radioactivity to the environment.	88
LANL soil posting criteria and implementation guidance for environmental contamination have not been sufficiently developed or implemented to ensure that existing soil contamination areas around the site are appropriately identified and controlled in accordance with LANL site radiation protection requirements and expectations.	89

APPENDIX C

Guiding Principles of Safety Management Implementation

C.1 INTRODUCTION

The Office of Independent Oversight and Performance Assurance (OA) evaluation of safety management systems focused on the seven guiding principles of integrated safety management (ISM) as applied at the Los Alamos National Laboratory (LANL). This appendix discusses the results of the first five of those:

- Guiding Principle #1 – Line Management Responsibility for Safety
- Guiding Principle #2 – Clear Roles and Responsibilities
- Guiding Principle #3 – Competence Commensurate with Responsibility
- Guiding Principle #4 – Balanced Priorities
- Guiding Principle #5 – Identification of Standards and Requirements.

The other two guiding principles (Guiding Principle #6 – Hazard Controls Tailored to Work Being Performed and Guiding Principle #7 – Operations Authorization) significantly overlap the core functions of safety management, which are discussed in Appendices E and G.

The OA team reviewed various documents and records, including the sitewide and Office of Los Alamos Site Operations (OLASO) and LANL ISM system descriptions; associated procedures; Functions, Responsibilities, and Authorities Manuals (FRAMs); and LANL plans and initiatives. In the evaluation of the guiding principles, OA considered the results of the OA review of the core functions, environmental programs, and essential safety systems. OLASO and LANL personnel were interviewed to determine their understanding of the ISM program and their responsibilities, as well as the status of ongoing initiatives and corrective actions.

C.2 RESULTS

C.2.1 Line Management Responsibility for Safety

Guiding Principle #1: Line management is directly responsible for the protection of the public, workers, and the environment.

Policies and Expectations

DOE line management – the National Nuclear Security Administration (NNSA), the Office of Defense Programs (DP), the Albuquerque Operations Office (AL), and OLASO – has worked effectively with LANL to establish an adequate set of environment, safety, and health (ES&H) policies and performance expectations for LANL, with a few exceptions in waste management and pollution prevention. These policies and expectations are established in the contract between the U.S. Department of Energy (DOE) and the University of California (UC) and include an adequate set of work smart standards (see Guiding Principle #5) as well as specific expectations and performance goals (e.g., zero injuries, illnesses, and environmental incidents). In addition, LANL has established institutional policies and goals that emphasize management commitment to safety and establish safety as a high priority at LANL. The first LANL institutional goal for 2001-2002 states "Safety and security are prerequisites for all our work. We never sacrifice safety or security in order to deliver on our programmatic or scientific tasks."

DOE line management used the latest DOE/UC contract negotiation process (contract signed in December 2000) to introduce a new set of performance initiatives (Appendix O of the contract). These new performance initiatives are designed to ensure that LANL improves in key areas, such as nuclear facility operations, authorization basis, and project management. The Appendix O initiatives include significant contractual penalties if LANL does not meet the parameters of the performance initiative.

Working in coordination with LANL, AL and OLASO have used the DOE/UC contract effectively to drive improvements in safety management and ES&H performance. LANL has made significant progress on the established Appendix O performance initiatives, most of which are scheduled for completion by the end of fiscal year (FY) 2002. The contractual performance metrics, many of which include baseline goals and more challenging "stretch" goals, have also focused LANL's attention on tracking and improving performance in a wide range of ES&H-related areas, such as radiation exposure, worker injury rates, and maintenance of safety-related equipment. In general, the performance measure trends indicate improvements in ES&H and facility support in recent years, and LANL injury and illness rates are low compared to similar industries and other DOE laboratories. AL and OLASO have continued to use contract modifications as a vehicle to drive improvements at LANL. The need for increased formality of operations was addressed through inclusion of the DOE conduct of operations order (DOE Order 5480.19) into the contract in March 2001. Subsequently, LANL, working with OLASO, developed a Laboratory Performance Requirement (LPR) to establish institutional expectations and an implementation plan. LANL has been conducting gap analyses at various facilities to determine actions needed to address the 18 elements of the conduct of operations order.

DOE/OLASO Leadership

In addition to the contract provisions, DOE line management has used the ISM verification process to drive improvements at LANL and OLASO. In the first ISM verification review in October 1999, DOE identified systemic weaknesses in the OLASO ISM program (e.g., weak issues management) and the LANL ISM program, including the lack of some of the important LPRs and Laboratory Implementing Requirements (LIRs) that establish institutional ES&H performance expectations and requirements. A second ISM verification review, in April 2001, confirmed that LANL had addressed the systemic programmatic weaknesses, and LANL was granted ISM implementation status, although several opportunities for improvement were identified, including the need for more formality of operations.

At the time of the April 2001 verification, OLASO had also corrected the weaknesses identified in the first ISM review by establishing better work controls and consolidating various oversight efforts. OLASO is continuing to work to improve issue management and tracking processes. OLASO has achieved these improvements by analyzing its work flowdown, starting with its basic mission of monitoring important elements of the UC contract.

OLASO has also demonstrated leadership in its effort to improve partnering and teaming with LANL through better and more frequent communications and joint activities. Examples of increased coordination include OLASO's participation in the definition and implementation of formality of operations, the development of a consolidated assessment plan with LANL, the LANL Oversight Working Group, and frequent communications between OLASO and LANL senior managers. However, increased attention is needed to improve coordination in the authorization basis area.

Although OLASO has demonstrated leadership, they do not currently have a permanent site office manager. The position is being filled on a temporary basis by an individual "on rotation." Establishing a permanent site office manager could provide more sustained leadership and consistent direction, which may be particularly important as OLASO assumes additional line management responsibilities in accordance with the March 2002 NNSA reorganization.

LANL Leadership

LANL senior managers have demonstrated sustained leadership over recent years in implementing an ISM program at LANL. The transition to ISM from the historical "expert based" approach to safety, which relied heavily on the experience and initiative of individuals to recognize and control hazards, has been challenging and has required sustained commitment by the senior management team to achieve acceptance at the lower tiers of management. Currently, support for ISM has filtered down to lower tiers of management—division managers, facility managers and group leaders—and ISM is widely accepted by the LANL and Johnson Controls of Northern New Mexico (JCNNM) workforce, including maintenance personnel, facility operators, laboratory personnel, scientists, and engineers. Although there are ongoing questions about how much rigor and formality is needed and exactly how to implement ISM, interviews with LANL management and workers indicated that ISM goals and objectives for integrating safety in all aspects of work are well understood and accepted.

In the transition to ISM over the past five years, LANL senior management encountered a number of obstacles and challenges as they worked to balance the need for rigorous and formal safety processes with the need for flexibility in implementing their programmatic and research mission. The challenges of implementing ISM were compounded by the need to consider the numerous types of operations and activities at more than 100 different LANL facilities, the differing management systems and practices across more than 30 largely autonomous laboratory divisions and groups, the wide range of hazards at facilities and laboratories, and the complex organizational interfaces associated with operations at facilities that host numerous tenants who often share laboratories and equipment. Over the years, LANL has tried various approaches for assigning line management responsibility (e.g., matrix management, facility management units, facility-tenant agreements) and has implemented various initiatives. Some of these approaches and initiatives were generally successful (e.g., performance metric programs), and others did not achieve management expectations or were not timely. Some approaches and initiatives were discontinued in favor of different approaches or newer initiatives, contributing to delays in achieving ISM implementation. Throughout these efforts, however, senior management remained committed to ISM and the fundamental ISM principle that line management is responsible for safety.

Currently, LANL management has identified an interrelated set of new and additional initiatives that they believe will further enhance the ability to effectively and efficiently implement ISM across LANL organizations and facilities. These include:

- **Integrated management**. Senior management is using ISM as a model for integrated management in other areas across LANL, such as security management.
- **Reorganizations to better define responsibility and accountability.** A reorganization in the summer of 2001 abolished the matrix management approach for programs and line management, and consolidated operations and ES&H under one Associate Laboratory Director. In a later reorganization, LANL realigned a number of service organizations to strengthen environmental management and the performance assurance function. These actions are intended to provide a clear focal point for accountability and clarify the organizational interfaces.
- **Reducing the number of facility management units (FMUs).** LANL management determined that they have had too many FMUs, each with different approaches and processes. LANL is planning to consolidate FMUs to achieve more standardization and consistency across facilities with similar missions and hazards, facilitate integrated management, and better utilize ES&H support.
- **Nested Safety Committees**. These committees are established at all levels of LANL operations. The process is designed to elevate unresolved safety issues throughout the Laboratory's hierarchy, if necessary to the highest level (i.e., the Director's Central Safety Committee, composed of the Senior Executive Team members). Currently nested safety committees are functional at the Radioactive

Liquid Waste Treatment Facility (RLWTF) and are being established at the Chemistry and Metallurgy Research (CMR) facility.

- **Feedback and Improvement Board**. This Board consists of division directors and is chaired by the Associate Laboratory Director for Operations. It will oversee requirement developments, receive self-assessment rollups, handle environmental priorities, and monitor trending and analysis efforts.

These initiatives are in various stages of development and/or implementation. In addition to the management system initiatives listed above, LANL is working on other initiatives to address weaknesses identified in various LANL and external assessments, such as a 2001 assessment by a contractor (the "BWXT assessment"), ISM verification, and the LANL technical safety requirement implementation reviews. LANL has a detailed project management plan to address a wide range of problems identified by some of the recent assessments. As examples, LANL is further developing a performance indicator program, working to enhance management walkarounds, and taking steps to enhance formality of operations.

Although significant progress has been made, much work remains to be accomplished. While no major programmatic breakdowns were identified, this OA inspection identified weaknesses in a number of important ISM areas, such as LANL feedback and improvement systems, configuration management, and implementation of certain requirements, such as environmental as-low-as-reasonably-achievable (ALARA) requirements. Some of these problems are attributed to the complexity of interfaces among facility and groups, and processes that have not yet reached full maturity. Further, limited progress has been made at LANL in some important areas, such as establishing effective operating procedures and ensuring procedural compliance (see Appendices E and F and the finding on procedures in Appendix E). The establishment of a formality of operations program is an appropriate step toward improvements in these areas but is in the early stages of development and implementation. Continued LANL management attention is needed to ensure that ongoing initiatives are completed on schedule and that management expectations for ISM and formality of operations are frequently reiterated and reinforced at all levels of management. Strong and sustained leadership by the facility managers and group leaders is particularly essential to ensure that the need for formality of operations and effective implementation of conduct of operation requirements is understood and accepted by the workforce.

Worker Participation and Empowerment

OLASO and LANL have established appropriate policies and mechanisms to involve workers in safety and empower workers to stop work if safety concerns arise and report safety concerns to management. These include the work planning processes that promote worker participation in hazards analysis and development of controls, the nested safety committees, stop-work procedures, and employee concerns programs. The processes encompass JCNNM subcontractors as well as LANL employees, and JCNNM management is actively involved in safety committees and other worker empowerment efforts.

The selected aspects of these programs that were reviewed were effectively implemented and adequately communicated to the workforce. For example, the LANL stop-work process is well documented and comprehensive, and it specifically covers situations where the worker observes serious hazards associated with work performed by others. The stop-work policy clearly states that retaliation for stopping work is prohibited. The OA team's observations and interviews confirmed that workers and managers were willing to stop work or pause to better understand questions about hazards, controls, and work performance.

LANL has initiated a number of innovative concepts for empowering workers and promoting safe work behaviors. The nested safety committees provide an innovative mechanism for communicating information from the highest levels of management to all LANL and JCNNM personnel, and provide every worker an opportunity to raise ES&H-related concerns. According to the nested committee concept, every employee belongs to a lower-tier committee. At least one member of every lower-tier committee serves on a corresponding higher-tier committee and thus is in a position to provide management perspectives at the working level. This nested approach is repeated at successively higher tiers and provides a potentially effective means of coordinating the efforts of the numerous committees at LANL. Another innovative program, implemented by the Nuclear Materials Technology (NMT) Division and entitled ATOMIC (Allowing Timely Observations Measures Increased Commitment to Safety), is based on workers observing other workers during the performance of work to identify potentially "at risk" behaviors and to promote awareness of safety throughout the NMT workforce. As part of this program, NMT has trained 342 people, including group leaders, team leaders, radiological control technicians (RCTs), and subcontractors. Approximately 2,700 work activities were observed during 2001 using this approach, and observations were documented for further analysis.

Summary of Guiding Principle #1. OLASO and LANL have established effective top-level policies and demonstrated leadership that has contributed to significant improvements in ISM and ES&H performance at LANL. Worker empowerment programs are also effective and include some innovative approaches. While significant progress has been made, continued attention is needed to achieve a mature ISM program and address identified deficiencies and the need for an effective conduct of operations program. Continued OLASO and LANL management attention is needed to ensure that ongoing initiatives are completed on schedule and that management expectations for ISM and conduct of operations are frequently reiterated.

C.2.2 Clear Roles, Responsibilities, and Authorities

Guiding Principle #2: Clear and unambiguous lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels within the Department and its contractors.

NNSA/DP/AL

Within NNSA, current line management responsibilities for LANL are well defined and understood. The DP Deputy Administrator provides programmatic direction to AL/OLASO and is responsible for LANL activities. The ES&H organization, within DP's Office of Facility and Operations, provides technical support to DP line managers on ES&H issues. The ES&H organization has recently started a program to conduct regular assessments of the effectiveness of DOE field elements in managing NNSA sites and laboratories. In addition, the ES&H organization is in the process of revising the five-year-old DP FRAM, with a target completion date of August 2002.

NNSA is in the process of extensively re-engineering its activities and organization to enhance and streamline line management of NNSA sites. As part of that re-engineering, OLASO will report to DP and will assume additional line management responsibilities for LANL, including contract management and line oversight functions. AL will function as a service center that supports OLASO and other NNSA field elements. NNSA plans to implement the reorganization between October and December 2002. The reorganization will require a realignment of responsibilities and authorities among DP, AL, and OLASO that will need to be defined and communicated to the individual organizational elements and staff.

The re-engineering initiative, and the transfer of the contract administration and evaluation function to OLASO, is another important step in the ongoing effort to empower the NNSA field elements to perform effective line management and line oversight of its contractor. Over the past several years, safety management responsibilities (e.g., authorization basis and restart authority) and line management oversight have increasingly been assigned to site offices. The transition of contract authority and the clear designation of OLASO as the line management element and AL as a support function are positive steps that provide OLASO with the contract authority and performance evaluation functions that are important to implement its responsibilities.

OLASO

Within OLASO, the roles and responsibilities for organizational elements and individuals with safety responsibilities are well defined. The OLASO ISM system description document provides for the flowdown of requirements from the AL FRAM to OLASO procedures. These procedures define the work assigned to each OLASO organizational element and clearly identify responsibilities of OLASO managers and staff who have important ES&H responsibilities. Interfaces with LANL and areas of accountabilities have also been defined in position descriptions for OLASO first line managers. (However, Volume II of this report, which addresses emergency management, identifies problems with OLASO roles and responsibilities.)

Also, OLASO has two ongoing initiatives to enhance its ability to carry out its line management roles and responsibilities. A senior OLASO staff member has been assigned to lead an effort to improve recognized infrastructure deficiencies with organizational interfaces and the quality of OLASO documents. OLASO is establishing an Office of Program Liaison to strengthen DOE oversight of LANL activities and serve as a focal point for interacting with LANL on project authorization, authorization bases, and issues management. OLASO is proposing this approach as a model for establishing roles, responsibilities, and authorities that could be adopted by other NNSA field elements.

LANL

Roles and responsibilities for institutional organization with ES&H responsibilities are clearly defined and implemented. For example, the ES&H division responsibilities include defining institutional ES&H policies, providing a single point of contact for the stakeholders, and providing performance feedback to upper management. Roles and responsibilities for institutional organizations are delineated in various documents, such as the ISM description document and division-specific program documents and procedures.

At the facility level, LANL uses its FMU approach to manage and support facility operations. FMUs are responsible for facility-related ES&H functions such as facility work control, hazards analysis, authorization basis, equipment maintenance, operational and safety procedures, and facility-level self-assessments and management walkarounds. LANL currently has 17 FMUs, each with its own approaches to implementing institutional requirements. The two facilities that were the focus of this OA inspection—RLWTF and CMR—are part of two different FMUs. The two FMUs have different approaches to organizing resources and assigning responsibilities that reflect their different facility missions and activities (CMR is a multi-user research and development facility, and RLWTF is an infrastructure facility). For example, at RLWTF, the facility ES&H and support personnel report to the RLWTF facility manager, whereas at CMR the facility manager, and the ES&H and facility support groups all report to the NMT Deputy Division Director. As discussed under Guiding Principle #1, LANL plans to reduce the number of FMUs in an effort to better utilize ES&H and maintenance resources and to standardize management processes and ES&H responsibilities. If effectively implemented, this initiative has the potential to facilitate further enhancements in ISM by providing for more consistent interfaces between institutional requirements/support and facility-level ES&H programs.

Within CMR and RLWTF, essential responsibilities for safety functions have been appropriately identified and assigned to various organizational elements. With few exceptions (e.g., quality assurance functions at RLWTF), facility-level procedures adequately describe how safety functions are to be implemented to perform facility-related and program work safely. Roles and responsibilities delineated in work control procedures (e.g., the safe work process and the facility maintenance work control process) provide for analysis and control of hazards for all work at LANL, are based on ISM core functions, and are well defined.

Although generally adequate, some aspects of roles and responsibilities warrant additional management attention and clearer delineation of management expectations:

- Some procedures do not adequately deal with interfaces among various organizations within FMUs. For example, procedures do not identify an individual position responsible for overall task.
- In a few cases, tools and guidance available to work planners, supervisors, and group leaders are not sufficient to facilitate consistently effective implementation of safety responsibilities, particularly when safety responsibilities require interfaces with other institutional organizations such as ESH-5 (see Appendix E).
- At CMR, the facility manager is responsible for facility safety for numerous laboratories but does not have the resources to determine whether ongoing work has been modified and thus whether it falls within the safety boundaries of the facility.
- Although the roles and responsibilities of JCNNM are formally defined in JCNNM administrative procedures, these procedures are not generally used and the process for assigning work to JCNNM workers differs from facility to facility.

LANL management is aware of some of these issues and is taking actions. For example, the CMR facility manager is trying to build on the FMU Integration Committee to achieve better coordination among different organizations within the CMR FMU. Also, the senior management initiative to reduce the number of and standardize FMUs has the potential to address some of the items above.

LANL has an effective system for flowing down the implementation requirements from its institutional goals into the annual performance review process for associate laboratory directors, division managers, group leaders, and team leaders. For example, the annual performance standard for the CMR facility manager includes management expectations for safe operation, authorization basis compliance, plant availability, and reduction of reportable occurrences. Performance standards that were reviewed assign appropriate weights to safety and facility operations. LANL senior executive team members emphasized accountability as an important element of their strategy to strengthen operations and implement their integrated management concept.

LANL is now beginning to focus on the challenging task of improving formality of operations and implementing a conduct of operations program. Historically, these areas have not been a major consideration in LANL performance evaluations for individual managers. However, the effectiveness and timeliness of implementation of conduct of operations programs could be promoted by using the existing responsibilities and performance evaluations for establishing clear expectations and management accountability for meeting those expectations.

As described under Guiding Principle #1, OLASO is effectively using the contract to define expectations and hold LANL accountable for performance. LANL has also effectively translated its ISM requirements into the JCNNM contract and established appropriate contractual mechanisms for monitoring JCNNM's ES&H performance and holding them accountable.

Summary of Guiding Principle #2. While a few areas warrant improvement, OLASO and LANL have established roles and responsibilities consistent with ISM expectations. OLASO and LANL have adequate systems for holding contractors and individual managers accountable for ES&H performance. The existing systems can be utilized to promote the needed improvements in formality of operations.

C.2.3 Competence Commensurate with Responsibility

Guiding Principle #3: Personnel shall possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.

OLASO

Obtaining and retaining the necessary technical staff and staff qualifications to provide effective oversight and safety management of LANL activities has been an ongoing long-term challenge for OLASO. Three assessments in the past two years have identified shortcomings in OLASO staffing and qualifications. An October 2000 self-assessment determined that the Facility Representative (FR) program was not adequately implemented and identified inadequate personnel resources as the principal problem. Following the accident investigation of plutonium uptakes at Los Alamos, a DP operational awareness program review concluded that OLASO needed to establish a cadre of ES&H functional area experts. A September 2001 Defense Nuclear Facilities Safety Board staff report concluded that OLASO had unmet technical staffing requirements, that the technical qualification program (TQP) for the technical staff continued to languish, that attrition was high, and that OLASO "may not be adequately staffed to handle their mission requirements and safety management functions."

DP, AL, and OLASO have been working to address staffing and qualification issues for several years and have made significant progress in a number of areas. Evidence of progress includes:

- Over the last three years, authorized technical staffing has been substantially increased (from 43 to 67), and onboard technical staff has more than doubled (from 24 to 57).
- 18 of the authorized FR positions are currently filled.
- In an effort to reduce turnover, OLASO was authorized to award a 10 percent retention bonus for all technical staff, promote FRs to the GS-14 level once fully qualified, and offer a relocation bonus of up to $25,000.
- Two training contractors were also assigned to mentor FRs and support FR qualification efforts, thus freeing the FR team leader to focus on supervising the FR oversight program.

The OLASO FR training and qualification program is well maintained and effectively administered. Oral boards are required for both Phase I and II qualifications. Further, a project plan has been established to efficiently manage FR qualification activities, and FRs have made good progress in completing qualification requirements. Currently, 10 of 18 FRs are fully qualified, 4 FRs are Phase I qualified, and 4 recently added FRs are well into their qualification programs.

Notwithstanding recent progress, OLASO remains shorthanded in qualified technical staff. The lack of an approved FY 2002 budget and the current hiring moratorium is hindering efforts to fill the remaining vacancies (ten unfilled technical staff positions) in a timely manner. In addition, OLASO has identified and justified the need for additional subject matter experts in areas where they currently lack sufficient expertise to effectively assess identified ES&H concerns. Further, limited progress has been made in addressing the long-recognized problems with OLASO personnel achieving TQP qualifications. Less than one third of the technical staff members and less than one half of the senior technical and safety manager designees are fully qualified.

Finding: Because of staff shortages and personnel who have not completed their technical qualification standards, OLASO does not have sufficient technically qualified personnel to appropriately perform all assigned safety management responsibilities.

Although OLASO staff shortages still need to be filled, the current authorized staffing level is generally adequate to accomplish assigned responsibilities, assuming that all vacancies are filled, all required qualifications are achieved, and technical support continues in areas where OLASO lacks sufficient expertise. In addition, the recently announced reorganization of NNSA will likely require a realignment of AL and OLASO responsibilities and staffing that will require significant management attention.

LANL

Staffing. The Laboratory Strategic Plan for 1999-2004 establishes generic strategic objectives for maintaining a high quality, motivated, and effective workforce of sufficient size to accomplish funded programs. Appendix O of the LANL contract includes an initiative that addresses staffing and competencies required to support future nuclear weapons program mission needs.

For the organizations reviewed, staffing levels were generally adequate to perform current ES&H-related functions and to appropriately support facility operations. Further, LANL has resolved previous concerns about the adequacy of RCT staffing through a substantial increase in staffing levels and aggressive efforts to fill the authorized positions. For the facilities and organizations reviewed, no significant staffing shortages affecting the safety of current work activities were identified by the OA team.

For the LANL facilities and organizations reviewed, planning for future staffing needs was principally focused on developing existing staff to offset potential future attrition. Current strategic staffing plans only addressed FY 2002 staffing, and a comprehensive basis for developing an FY 2003 staffing plan has not yet been established. Further, staffing plans now being developed for operators at CMR and the RLWTF, and for RCTs across the site, reflect no significant growth, despite the anticipation of significant growth in workload in the next fiscal year. LANL managers indicated that developing longer-term strategic staffing plans was not practical due to budget uncertainties. However, the length of time needed to hire, obtain clearances, and fully qualify individuals for new positions (typically two years for operators and RCTs) indicates a need to plan further ahead to ensure appropriate and timely support for future programmatic work.

One area of ES&H staffing concern was identified where further LANL evaluation is needed to assure that available resources are consistent with assigned responsibilities and priorities. Specifically, LANL's ESH-13 group provides and maintains the institutional training programs necessary for qualification and requalification of staff performing or supporting programmatic work. This group reports that they are meeting current training needs by working an average of 10 to 20 percent overtime and that some of their assigned responsibilities are being performed by other LANL organizations. However, ESH-13 may not have sufficient staff to support the surge in training workload that will accompany the pending influx of summer students and an anticipated large number of new hires in the next year, many of whom must complete a significant amount of initial institutional training. Opportunities to increase the efficiency of training by converting some required courses to a computer-based training format, thus reducing the need for instructors, have been identified but not yet funded. Contingency plans are now being developed to curtail some training services in anticipation of the arrival of summer students.

Training Programs. Facility and tenant management at CMR and the RLWTF recognize their line management responsibility for establishing effective training and qualification programs to ensure that individuals working in those facilities are competent to perform work safely. Current training programs are an integration of institutional, facility, position and task specific training. Training status is effectively tracked by LANL's Employee Development System (EDS). Based on the low injury rates, interviews with managers and supervisors, and OA team observations of work, existing training programs and work authorization processes generally provide adequate assurance that workers are competent to perform assigned tasks.

The current RLWTF training program is based on the systematic approach to training, uses a graded approach appropriate to a Category 3 nuclear facility, and is generally effective in establishing worker competence. A customized computer-based program provides an effective, user-friendly interface to the training records database and allows multiple preformatted reports that support needed supervisory inquiries. For example, a supervisor can quickly query the database to identify all individuals qualified on a particular task and/or all the qualifications of a particular individual. A current initiative to further improve the training program using a more rigorous systematic approach to training is under way.

CMR facility management (NMT-13) acknowledges that their current training program is not based on a systematic approach to training, does not have a DOE-approved Training Implementation Matrix, and does not support the level of formality required for conduct of operations for a Category 2 nuclear facility. This weakness was identified in a November 2001 internal review of CMR NMT-13 conduct of operations practices in support of implementation of DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*. Efforts are now under way to improve the CMR training program to bring it into compliance with the DOE order on nuclear facility training.

CMR tenant training programs are appropriate and complement required LANL institutional and CMR facility-specific training programs. Tenants used a combination of mentoring, on-the-job training, and work authorization to ensure position and task-specific competence. The Actinide Analytic Chemistry group's development of position-specific training programs encompassing all required training and reading assignments is notable.

JCNNM

JCNNM has a generally effective process for meeting LANL's current needs for maintenance craft personnel. JCNNM assigned a resident staff to each major LANL facility, including CMR and RLWTF. These staffs perform the baseline craft workloads and can be supplemented with additional resources from JCNNM's central staff. The resident staff approach also facilitates efficient maintenance of facility-specific training and qualification requirements.

The JCNNM training program has been generally effective in assuring the qualifications of provided workers meet LANL requirements. Supervisors have ready access to worker training status information, verify that training requirements are met on the work package, and are periodically alerted about pending training expirations. The OA team's observations of work indicate that JCNNM training program and work authorization processes adequately ensure that workers are qualified to perform assigned tasks.

JCNNM does not have an effective process for ensuring completion of the required annual briefings on the specific hazards associated with each skill-of-the-craft (SOC) qualification. SOC hazards briefings are required to be repeated at least annually. However, training records only show the completion of the initial SOC hazards briefing. JCNNM staff acknowledged that they have no mechanism to alert them if annual briefings are overdue, and some JCNNM staff incorrectly believed that annual refresher briefings were not required. One example of an expired SOC hazards briefing for a JCNNM individual was identified during work observation by the OA team.

Summary of Guiding Principle #3. Staffing and qualifications at OLASO have substantially improved in several areas; however, concerns with current technical staffing and the progress being made in TQP qualifications remain. LANL and JCNNM staffing, training programs, and work authorization processes generally ensure that current work activities are accomplished safely and effectively. However, the adequacy of staffing for the ESH-13 group is questionable in light of anticipated near-term increases in workload.

C.2.4 Balanced Priorities

Guiding Principle #4: Resources shall be effectively allocated to address safety, programmatic, and operational considerations. Protecting the public, the workers, and the environment shall be a priority whenever activities are planned and performed.

OLASO/AL/NNSA

NNSA guidance effectively defines mission, ES&H, and planning expectations that form the basis for achieving a balance between mission and safety at LANL. This guidance is generally timely and provides planning instructions to LANL for facility, infrastructure, and programmatic activities. The NNSA guidance provides the bases for important LANL planning documents, such as the Ten Year Comprehensive Site Plan (TYCSP), which addresses comprehensive site planning for facilities and infrastructure, and the Readiness in Technical Base and Facilities (RTBF) Implementation Plan, which addresses maintaining facility readiness conditions to support DP programmatic activities (including maintenance of safety systems and ES&H support).

OLASO has established appropriate contractual mechanisms to define both mission and ES&H expectations for LANL and to provide the basis for achieving balanced priorities. Appendix F of the DOE/UC contract establishes a number of performance measures that provide a framework for evaluating LANL performance in various mission, ES&H, planning, and operational areas. These performance measures address various aspects of ES&H, including ISM process improvements, authorization basis to ensure facility safety, environmental compliance, and worker safety. These performance measures also address strategic, institutional, and site planning as mechanisms for aligning missions, strategic direction, and funding. Appendix O of the contract provides additional program performance initiatives in such areas as nuclear facility operations, authorization basis, and project management. These additional performance initiatives are designed to ensure improvements in specific areas. The performance measures and initiatives in the contract provide for an appropriate balance between mission and ES&H programs and have been used effectively to drive improvements in LANL ES&H programs. For example, performance in the area of worker safety, as measured by accident and injury rates, has shown an improving trend in recent years as the benefits of ISM and performance metric monitoring have been realized.

The current DOE ES&H Management Plan does not serve as an effective planning tool for incorporating ES&H funding requirements into the overall budgeting process at LANL. This Plan, requested annually by the DOE Headquarters Office of Environment, Safety, and Health, is used to provide information on the cost of ES&H to Congress, but is not used to incorporate ES&H funding requirements into the budget process. The Plan also identifies ES&H risk management issues that are funded, as well as underfunded or unfunded ES&H-related activities and projects. Although valuable information is generated by LANL and other contractors, OLASO does not have a formal process for using this information as the basis for formally accepting the risk associated with underfunded or unfunded activities and projects. AL has recognized many of these weaknesses and recently led a task force to improve the content and use of this document. As a result, NNSA issued new guidance for preparation of the Plan that includes assigning to site offices the responsibility for ensuring that significant ES&H risks are addressed.

LANL

The LANL TYCSP effectively integrates mission, budget expectations, and facility/infrastructure requirements. The TYCSP serves as the top-level planning and integrating document and incorporates other major site planning activities, including the RTBF, the facilities and infrastructure revitalization program, integrated nuclear planning, decommissioning and demolition, and consolidation planning. The TYCSP links budgets and priorities through a LANL prioritized project list. In addition, LANL has established an LPR that addresses comprehensive site and facility planning. The current LIR for comprehensive site planning is being revised to incorporate the TYCSP and to more clearly define the roles and responsibilities for developing the various site plans that support the TYCSP. Presently, this LIR is undergoing management review, and a date for final approval has not been established.

Although the existing TYCSP is a useful planning and integrating mechanism, there are some aspects of the document the Laboratory recognizes as needing improvement. These include improving the quality of facility condition assessment information, improving the coupling of mission and facility needs for the long term, identifying long-term space needs, and raising security needs to a higher level.

The LANL RTBF Implementation Plan serves as an effective mechanism for planning, prioritizing, and allocating ES&H and other resources. It also provides an appropriate mechanism for ensuring that facilities and infrastructure are in place to support DP programmatic needs and that programmatic activities can be carried out in a safe manner. Under the RTBF program, direct funding is provided specifically for operation and maintenance of programmatic facilities. A formal risk-based prioritization process, which gives a high weight factor to ES&H, is used to develop an RTBF priority list for LANL. That prioritized list is used to allocate funding for ES&H, maintenance, and operations to support RTBF facilities. Both CMR and waste operations, including RLWTF, are essentially 100 percent funded through RTBF and have been accorded an appropriately high ranking on the priority list.

Budgeting and resource allocation processes are in place at LANL and provide an adequate level of ES&H resources to support facility and programmatic activities at CMR and RLWTF. ES&H resources are funded in three ways: RTBF, indirect overhead allocation, and direct programmatic funding. Budget targets are reviewed and approved by the senior executive team before being passed on to the divisions. In the case of RTBF and direct programmatic funding targets, division leaders and/or group leaders use those targets to negotiate with the ES&H division to arrive at the level of ES&H resources necessary to support facility and programmatic activities. In addition to management judgment, other factors are considered in the ES&H resource allocation process, such as historical needs and projected changes in both facility and programmatic work.

The interfaces between the Facility and Waste Operations Division (FWO) and JCNNM are well defined and provide an adequate means to flow down LANL's institutional plans and priorities to the JCNNM organization. For example, the FWO Utilities and Infrastructure group participates in the development of the TYCSP and interfaces with JCNNM on areas related to subcontracted functions. JCNNM is normally brought into the planning process one to two years in advance of project inception to allow for JCNNM planning activities, such as developing design and construction standards for TYCSP projects, identifying equipment needs, and providing design input to projects.

Using these processes, an adequate level of ES&H resources has been provided to safely support facility and programmatic activities at CMR and RLWTF in most cases. However, some isolated examples were identified in which ES&H functions have not been accomplished in a timely manner, in part because the allocation of resources and/or priority has not been sufficient. For example, RLWTF has not met its schedules for needed procedure upgrades. These schedules have been slipping over a two-year period, and RLWTF has completed only one out of nine main treatment operation procedures since March 2000. The procedure upgrade effort has been impeded because of the limited number of operators and the management decisions to use the available operators for mission priorities and other tasks (e.g., meeting Appendix F environmental performance milestones, reacting to the Cerro Grande fire aftermath). Waste processing operations at RLWTF have been held to an essentially flat budget for the past three to four years. During this time, inflation has eroded the available staffing and resources at the RLWTF even though the effects of flat funding have been partially offset by improvements in waste treatment technologies.

Other aspects of resource allocations and balanced priorities that affect present or future facility and programmatic activities include:

- At CMR, planners do not effectively plan and track the use of crafts and other support personnel (except for large jobs). This results in the less efficient allocation, use, and scheduling of these resources.
- LANL will be hiring approximately 1,000 full-time equivalents during this and next fiscal year. This staff increase will place a significant training workload on ESH-13 staff who are already working 10 to 20 percent overtime. Opportunities to increase the efficiency of training activities through the use of computer-based training have not been funded. The ESH-13 organization is developing contingency plans to curtail some training services.
- The information from past facility condition assessments, which are required by DOE Order 430.1A, *Life Cycle Asset Management*, has been insufficient and unreliable, detracting from the reliability of the TYCSP as an effective planning tool. Information from facility condition assessments is included in the TYCSP to help identify long-term needs and to plan resources and facilities as well as maintenance budgets. LANL was made aware of this deficiency as a result of the contractually-mandated 2001 assessment by an external contractor, and is considering corrective actions, including the possible adaptation of the Lawrence Livermore National Laboratory Facilities Assessment and Ranking System as a means of systematically developing accurate and useful facility condition assessments.

Summary of Guiding Principle #4. NNSA, AL, and OLASO have mechanisms that effectively establish expectations for achieving a balance in priorities between mission and safety at LANL. These expectations have been communicated through NNSA mission and planning guidance as well as performance measures and performance initiatives in the DOE/UC contract. LANL's planning and prioritization processes that are employed as part of the TYCSP and RTBF Implementation Plan effectively integrate mission, budget, and facility/infrastructure requirements to safely support DP programmatic needs. LANL recognizes that information from past facility condition assessments has been unreliable and detracts from its usefulness as an integral part of the TYCSP, and is in the process of developing corrective actions to address this shortcoming. An adequate level of ES&H resources for achieving a balance in priorities between mission and safety has been provided at both CMR and RLWTF. However, some isolated examples were found where the allocation or prioritization of ES&H resources has not been sufficient to meet established schedules and support anticipated training needs.

C.2.5 Identification of Safety Standards and Requirements

Guiding Principle #5: Before work is performed, the associated hazards shall be evaluated and an agreed-upon set of safety standards shall be established that, if properly implemented, will provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.

AL/OLASO

AL and OLASO have set the foundation for effective requirements management by working with UC and LANL to establish an appropriate set of requirements in the LANL contract. These requirements were initially selected pursuant to DOE Manual 450.3-1, *DOE Closure Process for Necessary and Sufficient Sets of Standards*, based upon a comprehensive review of work and hazards at the site. The selected requirements, which were included in Appendix G of the LANL contract as a work smart standard set in 1997, appropriately reflected the work and hazards that existed at that time. Since that time, DOE and

UC have made a number of changes to the LANL contract to maintain the work smart standard set consistent with DOE expectations and changing hazards. AL has provided continuing support by screening new and revised DOE orders and notices for inclusion in the contract, and OLASO has worked with UC and LANL to establish and implement a process for making changes to work smart standards. This process includes evaluation of proposed changes by a Change Control Board that is chaired by OLASO and includes members from AL, LANL, and UC.

The process for keeping the LANL work smart standard set current has been effective. Changes have been made to reflect changes in DOE directives and to enable DOE to hold the Laboratory more accountable in areas where improvement in performance was needed. No ES&H performance problems were identified by the OA team in this inspection that were attributed to deficiencies in the LANL work smart standard set. The formal Change Control Board process for evaluating proposed changes to work smart standards has provided a valuable forum for sharing views and reaching common understandings about proposed changes. The process for developing proposals for consideration by this Board is less structured but has generally succeeded because knowledgeable AL and/or OLASO staff members have taken the initiative to identify and propose needed changes. The process for identifying and proposing changes to work smart standards does not clearly define the types of documents to be screened, the criteria to be met for proposing changes, and responsibilities for developing proposals. AL and OLASO have acknowledged the need for more formality in this process to ensure that the work smart standard set remains consistent with DOE expectations as facility conditions and hazards change, and to ensure that responsibilities are carried out as the AL and OLASO organizations realign responsibilities and staffing in accordance with the recently-announced NNSA reorganization.

LANL

The LANL requirements management system is based on the contractual requirements established in the work smart standard set (see Figure C-1).

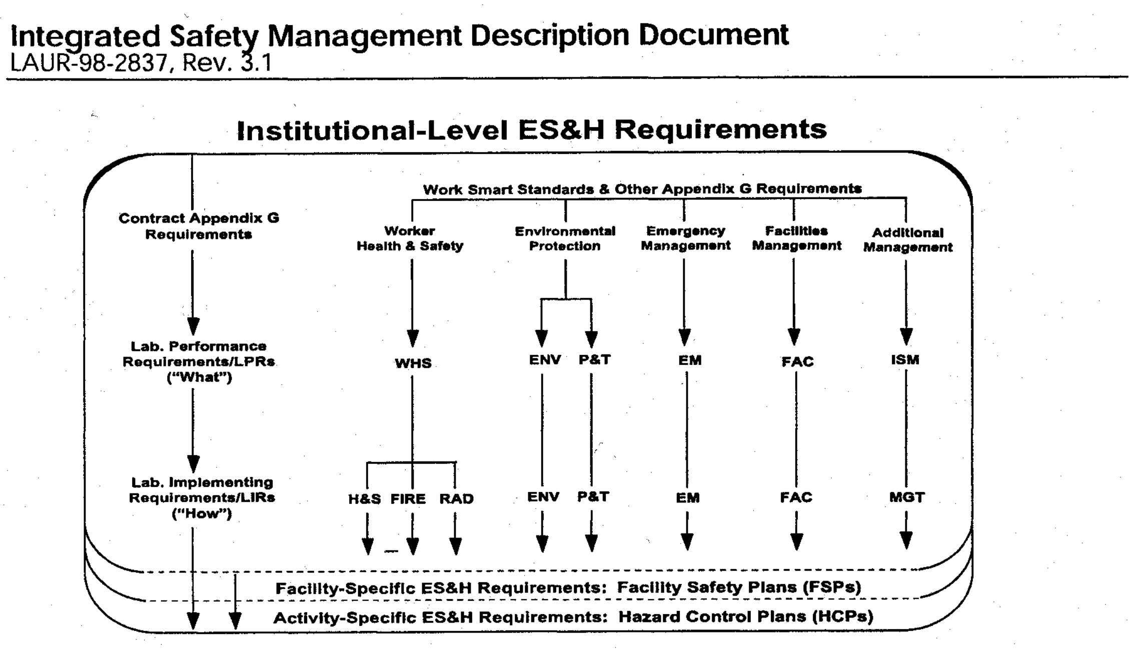

Figure C-1. LANL Requirements Management System for the Flowdown of Requirements from DOE/UC Contract Work at the Facility and Activity Levels

At the institutional level, LANL establishes a set of standards, requirements, and guidance documents to implement the work smart standards. These institutional-level documents include LPRs, which establish overall performance requirements for major programs such as ISM; LIRs, which establish requirements applicable to the LANL site in various areas such as radiation protection; and Laboratory Implementing Guides (LIGs), which provide detailed guidance for implementing selected programs and requirements. These institutional documents assign responsibilities and specify objectives to be met by line managers, while leaving the managers considerable latitude in the steps to be taken in meeting these objectives. This latitude in institutional requirements enables line managers to tailor their actions to address the wide range of activities and hazards at LANL. At the facility and activity levels, LANL divisions and groups develop hazards analysis documents (e.g., hazard control plans), facility safety plans, and procedures that assign responsibilities for implementing institutional requirements and tailor the requirements to the work.

The requirements management system is an integral part of the LANL ISM program and has improved significantly in recent years as LANL has established and implemented their ISM program. In most cases, the set of institutional standards and requirements is sufficient to implement work smart standards. For the most part, LPRs, LIRs, and LIGs establish clear requirements and appropriately designate responsibilities for implementing those requirements.

LANL has developed many procedures that adequately implement institutional requirements. Individual LANL divisions and groups have developed implementing procedures and provided associated training to ensure that institutional requirements flow down from the institutional level and are implemented at the facility and activity levels. Divisions have established points of contact to coordinate the implementation of new requirements and to report the status of implementation. Although the processes are generally adequate, several managers at the division and group levels indicated that they have had some difficulty in meeting the performance expectations established in institutional requirements. LANL has established processes to ensure identification and analysis of hazards prior to the start of work. As discussed in Appendix E, all work performed at LANL, including work by LANL subcontractors, is required to be performed using one of the two LANL work control processes, which reflect established requirements and standards. Although procedures were generally adequate, some deficiencies in the adequacy of procedures and procedural implementation were identified by the OA team. For certain activities, such as operation of safety-related systems, LANL is in the process of developing facility operating procedures that will provide specific instructions about hazards and controls to operators, maintenance personnel, and other LANL workers. The activity-level procedures are at various stages of development and implementation. Discussions in Appendices E, F, and G and Guiding Principle #4 provide additional information about the positive aspects and weaknesses in facility- and activity-level procedures and the implementation of requirements. These appendices identify significant weaknesses in procedure availability, use, and adherence. However, LANL management has self-identified similar concerns, and several actions are ongoing, such as implementing the conduct of operations order and developing facility operating procedures. However, timeliness of procedure development is an ongoing concern.

For subcontracted activities, LANL has established a sufficient set of ES&H requirements in contracts issued to its subcontractors and has established a contracting process to ensure that appropriate controls are provided. Solicitations include a list of institutional controls that must be applied to control site hazards, and bidders are required to meet pre-established safety performance criteria. Subcontractors are not authorized to begin work until their hazard assessment plan has been approved and they have received a notice to proceed by LANL. LANL subcontractors and their subtier subcontractors are required to conform to LANL work control processes. LANL holds its subcontractors accountable for work performed by their subtier subcontractors and requires that they supervise the work of their subtier subcontractors. JCNNM, the largest LANL subcontractor, is required to implement all applicable LIRs.

Most aspects of the requirements management system at LANL are sound, most aspects of the higher-tier documents are effectively implemented, and progress is being made to complete the lower-tier procedures. However, some gaps were identified in institutional requirements, and implementation deficiencies were evident in parts of the requirements management system. While not indicative of systemic problems, the observed deficiencies warrant additional attention and fall into three general categories:

- **Gaps in Institutional Requirements.** Institutional requirements have not been fully established in some environmental areas in that DOE environmental protection orders are not fully reflected in an LPR and LIRs. This concern was noted in the areas of managing radiological discharges, groundwater protection, and pollution prevention. In the area of occupational safety, no institutional requirements have been issued for performing initial or baseline surveys of CMR work areas or operations to identify and evaluate potential worker health risks as specified by DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, and required by work smart standards. At CMR, the exposure assessments and worker health risk surveys are not currently being performed as required by this DOE order.

- **Isolated Failures To Fully Identify and Implement Institutional Requirements at the Facility and Activity Levels.** As discussed under Guiding Principle #3 and Appendices E, F, and G, there were isolated instances of failure to fully implement certain institutional requirements. As examples, a systematic approach to training was not applied by NMT-13 at CMR as required by DOE Order 5480.20A, *Personnel Selection, Qualification and Training Requirements for DOE Nuclear Facilities,* and the laboratory training LIR; and LANL LIR site soil posting criteria and implementation guidance were not followed for the RLWTF outfall and other contaminated canyon areas.

- **Insufficient Monitoring of the Status of Requirements Management System and Its Implementation.** LANL self-assessment and self-reporting systems have not been fully effective in identifying implementation deficiencies. For example, the LANL LIR implementation status report incorrectly identified certain LIRs (e.g., LIRs that cover facility condition assessment surveys and soil postings) as implemented when they had not been fully implemented. LANL did not establish criteria for reporting on the status of implementation for the LIR status report, and the criteria being used by NMT and FWO did not include assessment of work practices and thus was inconsistent with the definition of implementation in the LANL ISM system description. Additionally, LANL self-assessments typically do not monitor LIR implementation status or compliance. The self-assessment LIR assigns responsibility to safety function managers for regular evaluations of conformance to institutional requirements. However, the assessments conducted by safety managers in FY 2001 did not address areas where the OA team identified deficiencies in implementation (e.g., training and radiological postings), and most of these areas are not within the scope of planned FY 2002 assessments. Appendix D provides additional information about weaknesses in self-assessment and feedback and improvement programs, as well as LANL's efforts to improve in this area.

Some of the current weaknesses identified above had been previously identified by internal LANL assessments or reviews by external organizations. Management is in various stages of developing and/or implementing corrective actions.

Summary of Guiding Principle #5. DOE and UC have established an agreed-upon set of work smart standards that, if implemented, is sufficient to ensure safety at LANL. With some exceptions, these standards have been conveyed to LANL line organizations through a comprehensive set of institutional standards, requirements, and guides. Implementation of established institutional requirements is improving but incomplete in some areas, and monitoring of the status of implementation has not been fully effectively. Processes for keeping work smart standards current and complete have functioned adequately, but AL and OLASO recognize the need for more formality in this process to ensure that the work smart standard set remains consistent with DOE expectations.

C.3 CONCLUSIONS

Overall, OLASO and LANL have established the framework for a comprehensive and effective ISM program. Policies have been effectively established and communicated. Workers and stakeholders have multiple avenues for expressing ES&H concerns. OLASO and LANL roles and responsibilities are adequately defined with few exceptions. LANL and JCNNM personnel are well qualified to perform their responsibilities and exhibited a good understanding of facility hazards. OLASO and LANL have established priorities that reflect the importance of safety and have implemented management systems to ensure that ES&H needs are considered and balanced against mission needs at all stages of project planning. Systems for identifying applicable requirements and ensuring that they flow down to the work level through policies and procedures are effective in most cases.

Some aspects of the OLASO and LANL efforts to enhance ISM are innovative and provide a sound framework for continued improvement. OLASO is effectively using the DOE/UC contract to establish specific ES&H/ISM performance expectations and drive improvements, such as the incorporation of the conduct of operations order into the contract. LANL has been innovative in their nested approach to safety committees as a tool to promote worker involvement and communicate concerns.

Although much progress has been made, increased attention is needed in a number of areas. OLASO has shortages of experienced personnel in important technical areas. Although significant progress has been made, efforts to fill ten vacant positions have been hindered by a staffing moratorium, and many individuals have not completed qualification requirements. In addition, while significant progress has been made, much work remains to be accomplished to achieve a mature ISM program and address identified deficiencies. Continued OLASO and LANL management attention is needed to ensure that ongoing initiatives are completed on schedule. Also, sustained leadership is needed to ensure that management expectations for formality of operations are articulated and that individuals are made responsible and held accountable for timely and effective implementation of formality of operations.

C.4 RATINGS

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

Guiding Principle #1 – Line Management Responsibility for Safety........ EFFECTIVE PERFORMANCE
Guiding Principle #2 – Clear Roles and Responsibilities .... EFFECTIVE PERFORMANCE
Guiding Principle #3 – Competence Commensurate with Responsibility. EFFECTIVE PERFORMANCE
Guiding Principle #4 – Balanced Priorities... EFFECTIVE PERFORMANCE
Guiding Principle #5 – Identification of Standards and Requirements...... EFFECTIVE PERFORMANCE

C.5 OPPORTUNITIES FOR IMPROVEMENT

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

OLASO/AL/NNSA

1. **Continue to provide leadership and emphasize management priorities to drive improvements in the LANL ISM program.**
   - Assign a permanent site office manager as soon as practical to provide continuity, sustained leadership, and consistent direction.
   - Ensure that ongoing OLASO and LANL initiatives are completed on schedule.
   - Reinforce DOE expectations for ISM and conduct of operations.
   - Consider incorporating formality of operations as a performance initiative in Appendix O of the contract.
   - Provide increased formality in the process for screening DOE directives and standards for inclusion in the LANL work smart standards. Specify the types of documents to be screened and the criteria to be met for proposing changes to work smart standards.

2. **Further enhance the usefulness of the ES&H Management Plan as a budget and risk management tool.**
   - Formalize a process for using the information in the ES&H Management Plan as a basis for accepting risk associated with underfunded/unfunded ES&H activities and projects.
   - Determine whether budget information in the ES&H Management Plan can be used as part of the DOE budget process, and, if so, develop a process for integrating that information into the budget cycle.

3. **Continue to enhance OLASO staffing and competencies.**
   - Clearly establish and routinely support and reinforce a management priority for completing TQP qualifications.
   - Identify and implement options for filling vacant technical positions on an accelerated basis.
   - Systematically evaluate longer-term staffing needs in light of the realignment of OLASO and AL responsibilities, and develop a strategic staffing plan for obtaining technically qualified ES&H professionals.

LANL/JCNNM

1. **Establish formality of operations as a senior management priority and use existing management systems to ensure timely and effective implementation.**
   - Clearly articulate senior management expectations for formality of operations and timely compliance with conduct of operations requirements.
   - Establish clear performance objectives for division directors, group leaders, and team leaders and incorporate those objectives into performance evaluations to ensure accountability for effective and timely expectations.
   - Make formality of operations a focus of self-assessments and management assessments; critically evaluate performance and take timely corrective actions where necessary.
   - Establish efforts to enhance tools and guidance available to work planners, supervisors, and group leaders to facilitate consistently effective implementation of safety responsibilities, particularly when safety responsibilities require interfaces with other institutional organizations.
   - Improve procedures to better address interfaces among various organizations within FMUs.
   - Provide facility managers with appropriate resources to allow them to determine independently whether ongoing work is within the facility safety boundaries.

2. **Further enhance existing strategic planning and resource allocation processes.**
   - Revise and reissue LIR 210-01-01.0, LANL Comprehensive Site Planning Program, in time to support development of the next TYCSP to be issued, including the following:
     - Integrate the TYCSP, as the LANL top-level planning document, in the revised LIR.
     - Clearly define the roles and responsibilities for all parties who provide planning input to the LANL institutional planning processes.
     - Incorporate requirements for developing and maintaining facility strategic plans into the site planning process.
     - Describe the purpose of the various institutional plans and their relationship to the TYCSP.
   - Develop and maintain strategic, forward-looking staffing plans for those ES&H and facility operations support positions requiring long lead times for hiring, obtaining clearances, and full qualification.
   - Determine the adequacy of resources and staffing at RLWTF to perform assigned tasks as well as enhance formality of operations and operational procedures.
   - Seek ways to improve the efficiency and use of craft and support personnel for small jobs at CMR.
   - Determine the impact on ESH-13 from the nearly 1,000 new personnel being hired at LANL and take appropriate action to ensure that ES&H training needs are met for these new personnel, including evaluations of the potential efficiencies of computer-based training.

3. **Further strengthen existing requirements management systems.**
   - Provide increased formality in the process for reviewing changes to regulatory requirements and industry standards to assure that those changes necessary for safe work at LANL are incorporated into Appendix G of the LANL contract.
   - Increase the emphasis on assuring implementation of LPRs and LIRs in self-assessments by line organizations.

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APPENDIX D

Feedback and Continuous Improvement (Core Function 5)

D.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluation of feedback and improvement at the Los Alamos National Laboratory (LANL) included an examination of the Albuquerque Operations Office (AL), the Office of Los Alamos Site Operations (OLASO), and the University of California's LANL programs and performance. The OA team examined AL and OLASO line management oversight of LANL integrated safety management (ISM) processes and implementation, including the Facility Representative (FR) program; environment, safety, and health (ES&H) program management; and the award fee/performance evaluation and measurement process. The OA team reviewed LANL institutional processes, such as assessments/inspections, employee concerns, lessons learned, and corrective action/issues management, and activity-specific processes such as post-job reviews. Selected facility- and activity-level feedback mechanisms were also reviewed. The National Nuclear Security Administration (NNSA) has recently established a process to conduct Headquarters onsite reviews of Federal field element performance. The first NNSA review of OLASO is scheduled for 2003.

D.2 RESULTS

D.2.1 OLASO Line Management Oversight

With a few exceptions, the oversight of LANL ES&H performance by OLASO is adequately described in a set of procedures that delineate the activities and responsibilities of FRs and Safety and Health Technical Representatives (TRs) in conducting day-to-day monitoring and functional area assessments and technical reviews. Day-to-day monitoring of contractor safety performance is conducted by 18 FRs (including 10 who are fully qualified). Two of the FRs are assigned to monitor the Chemistry and Metallurgy Research (CMR) facility. Four TRs conduct functional area assessments and technical reviews. The FRs and TRs report to the Assistant Area Manager of the Office of Facility Operations (OFO).

The OLASO line oversight program has been strengthened in the past few years by the addition of new staff. FR staffing has grown from 6 in 1999 to 18 as of April 2002. OLASO is actively recruiting for several additional technical specialists in the areas of criticality safety, fire protection, and maintenance. The need for significant increases in FR and TR staffing was identified during an OFO staffing needs analysis and FR program self-assessment performed in August 2000. This self-assessment resulted in 31 corrective actions that have strengthened the OLASO ES&H oversight program.

OLASO develops an adequate assessment schedule annually reflecting FR focus areas and planned, prioritized assessments. OLASO and LANL coordinate their assessment activities to avoid duplication of effort and identify opportunities for joint evaluations. This schedule appropriately considers various factors, including past performance, emerging issues, risk, scheduled contractor and external assessments, and mission changes.

TRs and subject matter experts from AL conducted a variety of formal assessments and technical reviews during calendar year (CY) 2001 in the areas of Occupational Safety and Health Administration requirements, fire protection, industrial hygiene, radiation protection, and several cross-cutting areas, such as work control and ES&H staffing. TRs issue a consolidated quarterly report summarizing safety and health assessment activities and presenting trend analyses of Occurrence Reporting and Processing System (ORPS) data and findings from TR and FR oversight activities.

Environmental subject matter experts frequently review technical documents and monitoring data generated by LANL. Rigorous OLASO oversight, inspections, and performance analysis are performed in the waste management area. However, OLASO has not conducted any assessments of implementation of DOE Order 5400.1, *General Environmental Protection Program*, or DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. In addition, OLASO has not yet defined processes to implement the recently established environmental auditing requirements of Executive Order 13148 and DOE Notice 450.1.

FRs at CMR routinely meet with facility managers and staff and attend facility planning meetings, critiques of potentially reportable events, and critiques of minor events documented on radiological incident reports. A quarterly report is prepared by FRs for each facility or area monitored by fully qualified FRs, summarizing monitoring and assessment activities, new issues, and the status of previously communicated issues. OFO management and staff communicate expectations, problems, current conditions, and oversight activities during a daily conference call. The OFO issues management procedure details the use of a computer-based tracking system for use by TRs and FRs to monitor the resolution of issues identified during contractor appraisal activities.

As discussed in Appendix C of this report, the contract between DOE and the University of California for the operation and management of LANL includes appropriate ES&H-related performance objectives, performance initiatives, and objective performance measures in Appendix O and Appendix F of the contract. Environmental performance measures are also appropriately included in Appendix F. Several measures provide incentives to achieve important environmental protection goals, including reduction of inventories of existing wastes; characterization of transuranic radioactive wastes; acceptance of orphaned sealed sources; implementation of the radioactive liquid waste strategic plan upgrades; compliance with environmental requirements, with particular emphasis on Resource Conservation and Recovery Act (RCRA) requirements; and achievement of pollution prevention and waste minimization goals.

Although the framework for an effective program is in place, the OA team identified several areas of weakness that are limiting the effectiveness of the OLASO oversight of LANL ISM performance. Specifically:

- **Many planned assessments are not conducted.** The TRs did not perform many of the assessments identified in the 2001 integrated assessment schedule. For example, 10 of the 12 scheduled radiological program assessments were not performed. In addition, FRs are not conducting reviews in the focus areas detailed in the assessment schedule in many cases. Assessment schedules have been aggressive but have not adequately specified priorities or accounted for available resources, including unplanned activities such as technical assistance to project staff or "for cause" reviews.

- **Deficiencies in LANL ISM processes and performance identified by OLASO line oversight programs are not consistently documented and transmitted to LANL in a timely manner to ensure that deficiencies will be evaluated, corrected, and tracked to resolution.** Some TR assessments (i.e., cross-cutting functional area assessments of work control and ES&H staffing conducted in 2001, and a technical review of a facility process hazards analysis) were never transmitted to LANL. In another case, although numerous individual deficiencies in LANL facility hazard categorization design documents were documented in a report and transmitted to LANL, no response was required. Further, the underlying issue of the overall inadequacy of the design and design review process was not identified by OLASO. FRs at CMR are identifying performance deficiencies and communicating the deficiencies to LANL verbally. In many cases, this process results in timely corrective action and facilitates the OLASO/LANL "partnering" initiative. In some cases, the FRs are identifying significant or recurring performance deficiencies (e.g., recurring errors in work packages and deficient radiological conditions and practices) that warrant a formal finding, rigorous evaluation, and a formal response from LANL including corrective actions. However, FRs are not categorizing significant deficiencies as findings as specified by OLASO standing instructions, so they are not transmitted to LANL in a manner that triggers an evaluation and formal response, as evidenced by the absence of any FR-identified findings at CMR in the most recent three quarterly FR reports. A contributing factor is that the criteria and thresholds for categorizing deficiencies as findings are not clearly specified. A compounding factor is the impression among some FRs and TRs that OLASO management expectations under the partnering initiative are to err on the side of collegial interactions with LANL and to minimize formal interactions that could adversely impact the improving relationship. OLASO management needs to clearly articulate their expectations for reporting findings through formal channels when deficiencies are significant or recurring such that a rigorous evaluation and a formal response is warranted.

- **OLASO issue management processes do not ensure that identified deficiencies are tracked to resolution and analyzed to identify systemic problems and/or trends.** Many FR findings, some dating back to 1997, have not been formally resolved. OLASO transmitted some assessment reports to LANL with a requirement for a response. However, LANL did not respond, and OLASO did not perform sufficient follow-up to prompt a LANL response; therefore, the issues in these reports were never resolved. OLASO personnel use a variety of informal and formal methods to track issues instead of the WinTrack system specified in standing instructions; the last entry by a CMR FR was in CY 2000. Findings from many industrial safety TR assessments are not input to the tracking system. Collectively, these deficiencies negate the value of the OLASO issue tracking system as a tool for identifying adverse trends and systemic problems and for providing OLASO management with accurate information about the overall status of identified deficiencies.

A number of OLASO administrative deficiencies contribute to the above weaknesses in the OLASO line oversight program. The OLASO document control process is not formalized and robust. For example, assessment reports and related documents, including responses from LANL, could not be located in office files. In addition, processes for transmitting assessment reports to LANL and for tracking findings identified by team assessments are not well defined. Further, there is no OLASO administrative procedure and policy system or self-assessment process.

Finding: AL and OLASO have not established and implemented a fully effective and efficient oversight and self-assessment program that ensures that LANL and OLASO are implementing ISM as specified in DOE Policy 450.5, *Line Environment, Safety and Health Oversight*.

Overall, OLASO has established and is implementing a formal oversight program for contractor safety management that has been significantly enhanced in the past two years by the expansion of the FR program and the establishment of the TR program. Day-to-day monitoring, formal assessments and technical reviews, and communication with facility and LANL management by the FRs and TRs provide the contractor with continuous feedback on safety performance. Safety-related performance objectives and measurable criteria with financial incentives have been built into the contract with LANL and are being closely monitored by OLASO. However, there are weaknesses in the OLASO line oversight with regard to performing scheduled assessments, communicating performance deficiencies to LANL, ensuring that identified deficiencies are evaluated and resolved, and issues management. Further, OLASO has not implemented a self-assessment process. Collectively, these weaknesses reduce the ability of OLASO to ensure that deficiencies are corrected and recurrences are prevented.

D.2.2 LANL

LANL has a number of institutional programs that provide feedback on the adequacy of ES&H processes and performance. These include assessments, issues and corrective action management systems, lessons learned, trend analysis and performance indicators, employee concerns programs, and safety committees. LANL also has a number of facility/activity-level feedback mechanisms.

Assessments. A variety of assessment activities are conducted at LANL to evaluate safety performance and implementation of ISM guiding principles and core functions. These include quarterly and annual division level assessments, management walkarounds, functional area assessments, semiannual performance evaluation summaries by safety function managers, and internal independent assessments by the Audits and Assessments office. The Feedback and Improvement Board (F&IB), composed of senior managers and supported by staff from the Quality Improvement Office and various organizations, oversees these processes and develops quarterly and annual evaluations of the effectiveness of the ISM system. Requirements and responsibilities for performing assessment are adequately defined in Laboratory Implementing Requirements (LIRs), Laboratory Performance Requirements (LPRs), and Laboratory Implementing Guides. The LANL Director and the F&IB staff issued additional expectations and guidance for the ISM implementation assessments for fiscal year (FY) 2002.

The Facility and Waste Operations (FWO) and Nuclear Materials Technology (NMT) divisions have issued annual self-assessment plans and management walk-around assessment plans and have conducted the specified quarterly assessments of ISM. The NMT self-assessment process is formal and actively managed. Quarterly NMT team assessments of ISM processes and various functional areas, including environmental protection, have been performed as required since October 2000. Individual safety function manager evaluations and collective summaries identified strengths and deficiencies in performance. Approximately eight internal independent assessment activities are performed annually by the Audits and Assessments office. Extensive (approximately 8,600) documented walkarounds were performed in CY 2001 by LANL managers. Guidance cards, developed to provide checklist items for enhancing the effectiveness of walkarounds, are often used. These management monitoring activities provide a valuable forum for communication between management and workers and provide management with direct data on plant conditions and personnel behavior.

ESH-19 conducts self-assessments on a semiannual basis for RCRA compliance at identified storage areas located within facilities across the LANL. Findings from the assessments are effectively used as a contract performance measure and tabulated results of the finding are discussed at LANL senior executive team meetings.

Although many assessment activities are performed by LANL, their overall effectiveness is limited by several process and implementation weaknesses:

- **Important ISM elements are not being routinely and rigorously assessed**. Walkarounds identify numerous physical condition deficiencies but few substantive performance issues. Many internal independent assessments and self-assessments are not identifying ISM process and performance deficiencies for resolution. In some cases, this results from insufficient rigor in the evaluation. In other cases, weaknesses are not properly described and categorized during the assessment and thus are not tracked and resolved. For example, FWO quarterly ISM assessments for FY 2002 were essentially analyses of existing data, primarily from selective sampling of management walkaround reports, rather than the required performance-based review of ISM. CY 2000 LANL internal independent evaluations of work control and facility management resulted in only one high-level management finding, although numerous process and performance deficiencies were identified within the assessment report. Further, no action plan has been developed to address the one identified management issue. Although elements of cross-cutting programs, such as issues management, self-assessments, quality assurance, lessons learned, and training, are addressed in facility-specific and functional area internal independent assessments, these areas are not being sufficiently evaluated for adequacy as LANL-wide ISM programs. The two safety function manager evaluations of "management systems" in FY 2001 did not address corrective action/issues management. ESH-19 RCRA audits provide useful information to correct specific compliance problems but line management is not consistently investigating violations identified by ESH-19 inspections to determine root causes and implement appropriate corrective actions. As discussed in Appendix G, waste storage deficiencies are a recurring problem.

- **Institutional requirements and direction are not ensuring consistently effective implementation of assessment programs across facilities and organizations**. The effectiveness of LANL line management assessments and walkarounds relies heavily on the experience and initiative of individual managers. For example, two division quarterly assessments are typically reporting adequate ISM implementation but are basing their conclusions on management self-assessments and walkarounds that have not performed rigorous evaluations of ISM performance. The F&IB was created as the institutional management focal point for LANL's self-assessment process but has not yet demonstrated effectiveness in establishing and monitoring implementation of effective self-assessment and issue management processes.

Issues and Corrective Action Management. Corrective actions for many ES&H deficiencies and issues are adequately tracked to resolution through a variety of informal and formal processes. The FWO evaluation and initial action plan development for findings from the 2001 BWXT assessment of LANL nuclear operations was an example of rigorous issue management.

Numerous tracking systems and an institutional issues management process are used to identify and track corrective actions for identified program and performance deficiencies. An Operations Support Tool (OST), issued in May 2001 and referenced in the self-assessment LIR, specifies an issues management process for issues identified by certain sources: quarterly line management self-assessments, semiannual safety function manager evaluations, internal independent assessments, and "special reports" from the Occurrence Investigation group (ESH-7). The OST describes a process for evaluating and risk-ranking issues, assigning owners, and inputting to a LANL tracking system called I-Track. Other formal and informal corrective action tracking processes are employed by various LANL organizations that conduct assessments or are assessed. Much of the data on institutional issues management (Audits and Assessments findings, various ES&H functional assessment issues, accident investigation judgments of need, ORPS, and some cross-cutting DOE assessment findings) from I-Track are made available to management and assigned owners for monitoring the status of issues, action plans, and individual actions. Responsible parties are regularly emailed information about past due issues and overdue action plans, and monthly summary report on all overdue and open issues from the institutional I-Track for all organizations are sent to the LANL Deputy Director. The Audits and Assessments staff verifies the adequacy of corrective actions for some institutional concerns by reviewing objective evidence for adequacy.

Although many elements of an issues management program are in place, ineffective management of the resolution of safety issues at LANL is an obstacle to further improvements in the LANL ISM program. The documentation, evaluation, and resolution of ES&H deficiencies and issues are not being managed in a structured, consistent, risk-based, and effective manner that supports continuous improvement. Weaknesses in issues management processes and performance include:

- **Many issues are not being input to I-Track or other tracking systems as required by LANL LIRs, the issues management OST, and the LANL ISM program description**. Issues not being tracked include: issues identified in the last three semiannual safety function manager evaluation reports, line management self-assessments, OLASO functional area assessment findings, certain CMR FR observations, and Audits and Assessments findings. The status and adequacy of any corrective actions, if any, for these issues are not being tracked to resolution.

- **Resolution of many deficiencies is not timely or effective, and follow-up is not adequate to ensure resolution and closure**. Findings from several FY 2000 and FY 2001internal independent audits remain open and have no action plans. Nine issues from an Audits and Assessments assessment of operational formality conducted in November 2000 are still open, most with July 2001 due dates. Several 2000 Cerro Grande recovery project issues are still open and still do not have an action plan. Many open issues in one of the issues databases are significantly past due. Corrective actions for approximately 40 issues in the "institutional" domains of I-Track are over six months past due.

- **Corrective actions are not always adequately verified prior to closure.** Several corrective actions from the March 2000 Technical Area (TA)-55 plutonium uptake Type A accident investigation involving lessons learned and issues management have been closed and verified based on inadequate objective evidence. For some of these, the identified corrective actions were implemented but have not been sustained. ORPS corrective actions are not independently verified or validated.

- **Existing guidance and tools do not support effective analysis, trending, and tracking**. The existing institutional issues management "support tool" does not define the term "issue," limits the process scope to a subset of ES&H issues, provides no timeframes for action, and does not address essential elements such as extent of condition or root cause evaluations. Further, divisions and facilities do not have procedures that adequately define issues and provide a structured and graded approach to the evaluation and resolution of issues not covered by the institutional process. The many corrective action tracking systems in use throughout the LANL complex, both informal and formal, are fragmented and fail to provide collective data to management to support trending and determination of overall ISM performance.

Currently, there is no formal plan to extend the applicability of the issues management process. Also, the issues management process does not have an institutional owner responsible for ensuring an adequate issues management program across LANL.

As discussed above, LANL feedback and continuous improvement program elements have some positive features processes but also have deficiencies that degrade their overall effectiveness.

Finding: LANL feedback and improvement mechanisms, particularly assessments and issues management, have not been fully developed and rigorously implemented to identify and effectively resolve ISM program and performance deficiencies and drive continuous improvement as specified in DOE Policy 450.4, *Safety Management System Policy*, and DOE Policy 450.5, *Line Environment, Safety and Health Oversight.*

Lessons Learned. Many elements of an effective lessons-learned program are in place. Many improvements in the way lessons learned are addressed at LANL have resulted from corrective actions from the March 2000 plutonium uptake event and Type A investigation judgments of need.

Lessons-learned information is readily available in a variety of venues, and lessons learned are being incorporated into procedures and shared with workers. Numerous institutional, division, and facility-level website links have cross-links to a variety of internal and external lessons-learned information. "Hot links" to lessons learned that may be applicable are provided in all LIRs. Some external and internal lessons learned are being screened at the institutional level and distributed, and some organizations are generating and distributing internal lessons learned. Lessons learned are shared in safety meetings and committees and have been incorporated into a variety of processes and procedures. A formal facility-level lessons-learned program at CMR addresses events that fall below ORPS reporting thresholds (typically radiological incident reports) through critiques and documented and tracked actions. Operating experience summaries, similar to the Office of Environment, Safety, and Health Operating Experience Weekly, are generated and distributed periodically.

Some aspects of LANL lessons-learned programs are innovative and notably effective. For example, a lesson learned is referred to in a CMR radiation work permit, which is a potentially effective and innovative way to communicate lessons learned. The incorporation of lessons learned into FWO engineering and maintenance manuals and maintenance and work control procedures, with footnotes and text explanations identifying the basis for individual requirements, is a noteworthy practice.

However, some ESH-7 procedural requirements are not being implemented as specified. For example, the specified biweekly operating experience summary was last published in August and September 2001. The required semiannual summary report of program performance was last issued in May 2001. The last lessons learned published on the LANL website was posted July 12, 2001. Some subject matter experts are not providing the required responses or responding in a timely manner. Communication and application of lessons learned at the Radioactive Liquid Waste Treatment Facility (RLWTF) has been informal and inconsistent. The NMT lessons-learned procedure and communication are unclear and not in consonance with institutional process and definitions. These implementation deficiencies degrade the effectiveness of a potentially noteworthy program.

Trend Analysis and Performance Indicators. Performance indicators are developed and issued frequently by many LANL organizations at the directorate, division, facility, and functional area levels. Trending information is generated and distributed to management and OLASO for monitoring and assessing safety performance. Data analysis and trending information is also provided to management for monitoring adherence to management expectations for implementation of such ES&H processes as management walkarounds and corrective actions. Much of this trending information is useful for monitoring performance and improving ES&H programs.

However, expected corrective actions are not always clearly defined when adverse trends are identified. Corrective action plans are not always developed or implemented in timely manner, despite the frequent status reports on overdue actions provided to management by issue and action owners. Improving the generation and use of performance indicators was one of the three opportunities for improvement in the AL/OLASO ISM verification report. A contract Appendix F measure for FY 2002 addresses this item, and an expanded, enhanced, and centralized LANL-wide performance indicator program is under development

Employee Concerns. The LANL safety concerns program is managed by ESH-7 and actively utilized by LANL personnel. It provides a structured, effective vehicle for employees to seek and obtain resolution of safety concerns, in anonymity if desired. Over 1,000 concerns have been documented and addressed in the last 3½ years. All but about 50 were resolved by concerned individuals' management, with the others addressed by ESH-7. The requirements for the safety concern program are described in an LIR. Training is provided to managers, and employees are made aware of the program during orientation and general employee training. A website provides the vehicle for reporting concerns and tracking resolution. Safety concern data is being tabulated, analyzed, graphed, and/or trended and presented to management in a variety of ways. However, there is no routine verification of adequacy of resolution by ESH-7.

Safety Committees. Various safety committees provide additional institutional feedback vehicles for improving ES&H performance. In addition, several committees and boards provide a policy-making and review function and a liaison between the various organizations supporting and employing feedback and improvement activities, including issues management.

LANL is implementing an extensive program of nested safety committees as a senior management initiative and to respond to an item in the April 2001 ISM verification by AL/OLASO. The intent of the nested safety committees is to strengthen line management commitment and worker involvement, and evaluation of implementation is included in the Director's written expectations for the quarterly division self-assessments. The concept is regular meetings at five different levels, from workers and teams up to the Director's Central Safety Committee, with concerns and issues passed upward and expectations, commitment, and resolution support moving downward. Data to date indicates that the committees are meeting as required, but a selective OA review of meeting minutes indicates that the documentation and communication of issues and resulting actions are not always rigorous. Management attention will be required to ensure that this relatively new initiative is fully implemented and becomes an integral and effective ISM feedback mechanism.

Activity-Level Feedback and Improvement. In addition to the assessment activities described above, CMR utilizes a number of other formal and informal feedback mechanisms for evaluating the effectiveness of programmatic work implementation, including behavior-based safety program activities and communication of safety and health information to the CMR staff. The OA team observed a number of work activities for which important lessons learned were effectively used and communicated. For example, following a recent acid splash incident in CMR Building Wing 5, lessons learned from the incident regarding the risks and hazards associated with this type of research activity were communicated in tenant group safety meetings. Other examples of effective lessons-learned application from other recent CMR contamination events were being developed or were already incorporated into work instructions.

Many feedback mechanisms and effective application of lessons learned for programmatic work are evident in CMR, particularly from the NMT division level. However, a formal mechanism for post-job reviews of CMR programmatic work did not exist in NMT division hazard and work control procedures.

The primary mechanisms for communication and feedback of facility management safety issues and lessons learned occurs in various daily routine meetings, such as the CMR morning facility status, pre-shift operations briefings, and afternoon plan-of-the-day meetings. For example, a safety topic is typically discussed during facility status meetings, which address both CMR facility-specific concerns and issues and lessons learned from outside CMR. These routine meetings are generally effective in providing feedback to CMR staff on management expectations, disseminating lessons learned, and providing information on incidents occurring within the previous 24 hours, including radiation incident reports. Meeting minutes are forwarded to the CMR staff.

For facility maintenance work, both CMR and RLWTF facility work control procedures contain provisions for documentation of post-job reviews. As part of the work package and in accordance with CMR work control instructions, every work package contains two sections that address the Problems Encountered (e.g., delays and safety) and Lessons-Learned/Recommendations sections of the Work Documentation form. However, supervisors and craft personnel rarely complete these sections. Similarly, at RLWTF, lessons-learned sections of work packages are being used to identify other maintenance deficiencies, not for identifying work control process improvements.

D.3 CONCLUSIONS

OLASO has established, executed, and is improving processes to monitor contractor ES&H/ISM performance. Safety performance measures that are included in the DOE/University of California contract are used by LANL and OLASO to evaluate performance and promote improvements. FR staffing levels have been increased in recent years to enable better coverage of nuclear facilities. Some identified program and performance deficiencies are not being properly categorized and formally communicated to LANL for resolution, and there have been significant delays in issuing assessment reports. Many planned monitoring activities and functional area assessments have not been performed. Many FR findings and observations at CMR have not been reported to LANL or resolved in a timely manner. Administrative weaknesses and process weaknesses in the OLASO line oversight program (insufficient policy and procedure system, no self-assessment process, and weaknesses in document control and records management) contribute to the observed implementation weaknesses.

At LANL, many mechanisms are being used to provide feedback and improvement in safety performance. Independent and management self-assessments are performed, deficiencies and issues are identified, corrective actions are developed and implemented, and lessons learned are applied. Various initiatives and process enhancements are ongoing to monitor and improve the implementation of ISM. However, inconsistencies and weaknesses in processes and the implementation of feedback and improvement mechanisms have hindered their effectiveness in driving continuous improvement. The feedback and improvement management systems suffer from a lack of clear institutional ownership, sufficient direction, and management accountability. Institutional division- and facility-level requirements for issues management are not well defined, and the numerous, fragmented informal and formal processes that are used have not been consistently effective in driving continuous improvement. Increased rigor is needed in the implementation of assessment activities and the identification and application of lessons learned. A new Performance Assurance Division has been established (April 2002) to bring the institutional ownership and responsibility for many of these management systems into one division-level organization.

D.4 RATING

OLASO and LANL have established numerous systems for identifying deficiencies and providing feedback to management. However, process weaknesses and inadequate implementation of these individual systems have limited their effectiveness in identifying and resolving deficiencies and preventing recurrences. As a result, a rating of NEEDS IMPROVEMENT is assigned.

D.5 OPPORTUNITIES FOR IMPROVEMENT

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

OLASO

1. **Enhance OLASO processes for consistently documenting, communicating and tracking the resolution of OLASO identified LANL performance deficiencies**.
    - Establish and implement an OLASO-wide policy and implementing procedures for identifying and communicating oversight findings to LANL, including expectations for a response or corrective actions. Monitor and track LANL responses when specified by OLASO.

- Ensure that an appropriate threshold is established for issues requiring a response from LANL, that the issue descriptions address the underlying systemic questions, and that issues and expectations are formally communicated to the appropriate management level.
- Improve or replace the WinTrack system to provide an effective and user-friendly issue tracking system that can generate summary status reports to facilitate evaluation of individual facility and overall LANL performance. Require and ensure utilization of this system by all OLASO staff for line oversight issues.
- Ensure that LANL enters OLASO oversight findings into a formal issues management system, and routinely monitor LANL's issue evaluation and corrective action status and effectiveness.
- Develop, routinely update, and adhere to a comprehensive, integrated, achievable ES&H oversight plan and schedule.
- Establish and execute formal protocols for the conduct of assessments by AL subject matter experts, including the development and approval of reports and communication of results to LANL.
- Establish an office-wide policy and procedures process.
- Establish a structured and centralized document control system to ensure consistency in issuing oversight reports and correspondence and retrievability of documents.
- Establish and implement a policy and procedure for regular self-assessment of OLASO processes and performance.
- Evaluate legacy FR findings and observations (e.g., findings dating back to 1997 for which their has been no formal response or resolution). Administratively disposition those that are no longer relevant or valid in light of the ISM implementation. Implement corrective actions where warranted.

LANL

1. **Significantly strengthen the management of ES&H issues and initiatives**.
   - Identify an organization as the institutional program owner for LANL issues management and empower it to consolidate and/or coordinate existing disparate responsibilities.
   - Elevate the requirements for the issues management program to the LIR level and establish a consistent, graded process for issues management to be applied by all LANL organizations.
   - Develop a comprehensive procedure that clearly defines the scope and requirements for managing identified ES&H program and performance deficiencies. This procedure should establish a consistent set of terminology for describing deficient conditions and performance; provide for consistent risk categorization and determination of extent of condition and causal factors; provide direction and guidance for developing action plans to prevent recurrence; establish specific timeframes for process actions; and provide for appropriate verification and validation of the effectiveness of corrective actions.
   - Conduct regular internal independent assessments of the implementation of issues management processes to ensure effectiveness in resolving deficiencies and preventing recurrence.

2. **Strengthen the lessons-learned program to ensure that appropriate lessons learned are consistently developed, screened, and applied to training and work activities at LANL**.
   - Develop an institutional-level procedure defining the requirements and responsibilities for implementing the program.
   - Ensure that screening of external lessons learned is consistently performed, that subject matter expert evaluations are conducted, and that any required actions are tailored to LANL processes and are implemented.

- Ensure that all institutional, division, and facility-level procedures and processes for training and work control specifically address the evaluation and application of lessons learned to LANL activities.

3. **Strengthen self-assessment processes**.
   - Establish an organizational owner with overall responsibility for the LANL self-assessment program.
   - Ensure that self-assessment of ISM implementation includes rigorous, performance-based techniques that focus on work, including watching work, evaluating the adequacy of work documents and records, and performing practical evaluations, such as procedure walkthroughs.
   - Ensure that all organizations have designated, trained coordinators and an infrastructure for assessment activities to ensure planned, coordinated, and effective performance.
   - Conduct regular internal independent assessments of the adequacy and effectiveness of self-assessment activities.

4. **Enhance safety committee operations.**
   - Ensure that support and advisory committees and boards have formal charters and defined membership.
   - Ensure that committee and board staff makeup and responsibilities are clearly and formally defined.

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APPENDIX E

Core Function Implementation (Core Functions 1-4)

E.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluation of work planning and control and implementation of the first four core functions of integrated safety management at the Los Alamos National Laboratory (LANL) focused on safety performance during conduct of facility maintenance and programmatic work activities at the Chemistry and Metallurgy Research (CMR) facility and the Radioactive Liquid Waste Treatment Facility (RLWTF). Examples of observed activities included CMR and RLWTF equipment preventive and corrective maintenance, RLWTF plant operations, and CMR programmatic work activities. In addition, work control systems and their implementation were reviewed. Procedures and policies, such as stop-work policies, were evaluated, and hazard analysis and control systems were examined. This approach enabled OA to evaluate differing work control processes governing facility management, facility operations, and laboratory programmatic work.

E.2 STATUS AND RESULTS

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

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

RLWTF Operations

Detailed operating procedures are used to define the scope of equipment operations within the RLWTF. Existing operating procedures adequately define the scope of work for specific operations, and plans to develop a chapter-based operating manual will further clarify the scopes. These procedures, supplemented with operating plans when specific treatment regimens are needed, provide adequate scope for day-to-day facility operations.

RLWTF Maintenance

RLWTF generally has an adequate definition of work for its maintenance work packages as required by the work control administrative procedure. The majority of the maintenance tasks are simple in nature and understood by the resident and non-resident crafts. Routine meetings with managers ensure that daily priorities are established and that required resources are coordinated between projects where necessary. Walkdowns for maintenance work are effectively used to correctly identify the scope of work. At RLWTF, work includes a walkdown by the craft foreman and the zone manager at a minimum. The walkdown is performed to clarify the scope of work (process engineers and applicable safety professionals are involved where necessary), to establish cost estimates for work package costs, and to identify any job/location-specific hazards for development of an activity hazard analysis (AHA) for the work package.

When major modifications or construction are involved, the description of the work in the Passport (work control) system is not always sufficiently detailed. For example, various information, such as work location and equipment numbers, is not being included in the Passport system but is typically included in a comment paragraph elsewhere in the work package. In addition, there is a tendency to only refer to the scopes defined in the included drawings rather than type them into the Passport system. This has a potential for problems when the drawings are included in the work request documentation but not included in the work package used by the workers. Also, because the location and equipment data fields are not being utilized, the Passport system cannot be used to periodically trend information regarding equipment or system reliability within the facility as required by the facility assets, maintenance history Laboratory Performance Requirement.

CMR Maintenance

The scope of work at CMR is clearly defined for jobs involving preventive maintenance, corrective maintenance, and modifications. There are routine meetings to ensure that priorities are established, that required resources are coordinated between projects where necessary, and that the scope is clearly understood by crafts and support personnel. Planning for work in CMR starts when supervisors meet to review the backlog of approximately 200 jobs, and the top 100 are ranked in order of priority. The top jobs on the short list are then put on the plan of the day (POD) based on crafts and support resources available. A daily POD is held to review the scheduled work for the next day and the work upcoming for the next ten days. In addition, managers and supervisors meet each morning to review work in each wing. Issues are discussed that could impair or stop work, and any safety concerns are discussed. This meeting is effective in assuring that key personnel are in agreement with the work in each of the wings.

A high percentage of maintenance work in CMR involves performing preventive and corrective maintenance. These work packages have been performed many times by an experienced crew of craft personnel, so the scope of these types of jobs is well understood. Walkdowns for maintenance and construction work are also effectively used to further verify the scope of work.

In some cases, scheduling, estimating, and resource requirements for specific activities are not adequate to ensure the work is performed when needed. At CMR, the planners do not make time estimates and track actual time (except for very large jobs) for crafts and support personnel. This prevents accurate scheduling and resource loading of crafts and support personnel, which could adversely affect efforts to reduce the backlog of work.

CMR Programmatic Work

LANL uses the safe work practices Laboratory Implementing Requirement (LIR) to establish the minimum expectations for the control of activity-level work. At CMR, ongoing programmatic work scope is defined though implementing documents such as hazard control plans (HCPs), work instructions, and safe operating procedures. Most HCPs and work instructions reviewed by the OA team adequately defined the work activities. For example, the work instruction for "Dilatometry and Resistivity Measurements" performed by Nuclear Materials Technology (NMT)-16 in Wing 2 provides a detailed description of the operation of the instruments, the location of the work, and the HCP that bounds the hazards. For new and revised programmatic work at CMR, the facility activity approval process is an effective and systematic method for defining and describing the work scope such that hazards can be identified, analyzed, and controlled.

Occasionally, a new, unexpected activity of short duration is identified that is not covered by an existing HCP. The NMT division has established a Short-Duration HCP (SD-HCP) process for limited duration operations (less than 90 days' activity) that may involve potentially hazardous activities. CMR currently has 17 active SD-HCPs. However, the description of the work activity in a number of these SD-HCPs was not sufficiently detailed to ensure that the hazards and appropriate hazard controls could be adequately identified. For example, the SD-HCP prepared for the cold testing of a Varian 979 helium leak tester, being performed by NMT-16 in CMR Wing-4, did not describe either the setup of the test apparatus or the method of introducing helium to the apparatus. Several SD-HCPs did not adequately address chemical or ergonomic hazards, and other SD-HCPs were not reviewed by the NMT safety and health staff.

In addition, there is no formal, documented agreement between the LANL Occupational Safety and Health Group (ESH-5) and divested environment, safety, and health division (ESH) staff (ESH staff assigned to a facility on a permanent basis to support line management), including the NMT safety and health team (i.e., a memorandum of understanding), that defines shared work scope and minimum safety and health expectations, or establishes a basis for whether a specific support activity should be provided by ESH-5 or NMT. For example, NMT has the flexibility of using a variety of industrial hygiene laboratories for processing chemical air samples, or purchasing industrial hygiene instruments independent of the ESH-5 instrument shop, or maintaining their own worker exposure record database independent of the ESH-5 worker exposure record database. In addition, ESH-5 has not communicated minimum qualification requirements for divested safety and health personnel to ensure that all industrial hygienists and safety engineers meet minimum institutional requirements.

Summary

Overall, CMR maintenance and RLWTF maintenance and operations have good frameworks in place for defining the scope of work and most processes are effectively implemented. The safe work practices LIR and Laboratory Implementing Guide (LIG), and NMT implementing documents at CMR for HCPs, the facility activity approval process, and SD-HCPs provide adequate and user-friendly guidance on how programmatic work should be defined at CMR. Most hazard control plans and work instructions that were reviewed adequately defined the work activities. Work definition could be improved by more detailed work scopes in SD-HCPs, and by documenting expectations between safety and health support groups to more effectively budget and allocate resources.

E.2.2 Core Function #2 - Analyze the Hazards

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

RLWTF Operations

RLWTF has a DOE-approved safety analysis report (SAR); however, it has not been revised since 1995 and does not accurately reflect current operations. In March 1999, the DOE Los Alamos Area Office (now the Office of Los Alamos Site Operations, or OLASO) approved a set of interim technical safety requirements (ITSRs) to establish more current safety controls while a new SAR was being developed. With the approval of the ITSRs, all but the safety analysis portion of the SAR was excluded from the authorization basis. Although this current authorization basis does not meet DOE expectations, a new 10 CFR 830-compliant SAR is being developed and is scheduled to be in place prior to the April 2003 deadline established by 10 CFR 830. The poor condition of the current SAR is also partially offset by the comprehensive nature of the facility's current unreviewed safety question (USQ) process.

The USQ screening/determination process is appropriately applied to new or revised procedures, as well as to facility modifications. Recent USQ screenings and determinations are comprehensive and provide adequate justifications for the results. Although one temporary modification in 1999 was installed without a USQ determination, recent examples of modifications and changes had the appropriate USQ evaluations. Overall, recent screenings and determinations were comprehensive and their quality was high.

With one notable exception, hazards and associated controls applicable to most RLWTF operations are adequately analyzed and documented in the Operations Safety and Hazard Control Plan. The plan includes documentation of the analysis for generic hazards and associated controls. The plan is supplemented by procedures for activity-specific hazards and controls. Hazard analyses for specific operations are governed by the safe work practices LIR, and hazards are analyzed as a part of the procedure development process. The new requirements for RLWTF operations procedures include development of an HCP during the procedure development or revision process, with the resulting controls integrated directly into the procedure.

However, in one case, a hazard associated with a change in RLWTF operations has not been adequately analyzed. Specifically, the potential hazard of the carbon dioxide (CO_2) released during gravity filter backwash operations may present a bigger hazard than previously analyzed. During this operation, 8 to 14 scfm of CO_2 is released into a low air velocity room for up to three days at a time, usually over the weekend. The facility is relying on an April 1990 analysis of CO_2 use in Room 116 during operation to conclude that the operation is safe. During operation, the analysis measured CO_2 concentrations as high as 5500 ppm at 8 feet downwind of the source. The current Occupational Safety and Health Administration permissible exposure limit is a time weighted average (TWA) of 5000 ppm. The analysis calculated a worst-case TWA of 2925 ppm; however, the calculations were based on operating the system for four hours per day, not over an entire weekend. The same calculation as described in the analysis would likely have resulted in a worst-case TWA of 5500 ppm if applied to the current operating practice. In addition, the analysis did not describe the elevation of the samples, so it is not clear whether layering effects of the CO_2 discharge were taken into account at that time. The analysis also may not have taken into account the hazard associated with the tendency of CO_2 to settle in low areas during low airflow conditions. The facility has notified the industrial hygiene representative of this concern. Facility management plans to have industrial hygiene take new measurements and reanalyze the hazard during the next filter backwash.

RLWTF Maintenance

The maintenance work control process at RLWTF utilizes the AHA and the ES&H site hazard and control processes together as a comprehensive tool for workers, work planners, and line supervisors to systematically identify maintenance work activity hazards and appropriate controls. The AHA process involves a comprehensive job walkdown that usually involves a job foreman, the Johnson Controls of Northern New Mexico (JCNNM) zone supervisor, planners, and the appropriate safety professionals where required. Reviews of over 120 work packages indicate that the process is being adequately and consistently implemented. Observation of work activities revealed effective hazard analysis of jobs, and craft and foreman buy-in on hazard mitigation.

JCNNM has researched and prepared a comprehensive catalog of skill-of-the-craft (SOC) activities and associated predetermined hazards and controls for specific tasks. Other than one case where a SOC task for the weekly, monthly, and annual preventive maintenance for air compressors was being used for a monthly preventive maintenance activity for a RLWTF vacuum pump, hazard analyses for the existing SOC activities are adequate.

The RLWTF utilizes the Facility Operations Review Committee to scope and plan and identify necessary actions to address hazards associated with new experiments, studies, modifications to the facility and new construction. The committee consists of senior Radioactive Liquid Waste facility managers, quality assurance (QA) personnel, and facility and process engineers. The committee meets each week to address new concerns and follow up on current issues. This committee supplements the AHA process and results in more comprehensive hazard analyses for these type activities.

CMR Maintenance

The maintenance work control process utilizes the AHA and the ES&H site hazard and control processes together as a comprehensive tool for engineers, workers, work planners, and line supervisors to systematically identify maintenance work activity hazards and appropriate controls. Walkdowns are an integral part of the AHA process and involve system engineers, craft personnel, planners, and appropriate safety professionals. For example, the walkdown of a job involving removal of a ventilation system blank identified a number of unique safety issues, including coordinating damper operation to assure good airflow into the system and the potential for presence of explosive perchlorates. The resulting controls adequately addressed the safety issues and included moistening the duct to reduce the potential for explosion, taking perchlorate swipes, and requiring workers to wear a ballistic suit external to anti-contamination clothing for protection in case of an explosion. These walkdowns are normally performed prior to pre-job briefings, but in cases where issues arise during the pre-job briefing, appropriate personnel review the issues at the job site. Reviews of over 30 work packages indicate that CMR personnel are adequately and consistently implementing the AHA process.

CMR Programmatic Work

Processes for the identification and analysis of hazards for programmatic work are well established at the institutional level though safe work practices, and at CMR though the facility activity approval process, HCPs, and work instructions. In addition, the unreviewed safety question determination and hazard analysis processes provide a sufficient means for ensuring that new or changed programmatic work activities are planned and conducted within the boundaries of the CMR facility authorization basis. For example, the hazard analysis for the synthesis of actinide nitrides project being planned by NMT-11 for CMR Wing 9 identified a number of potential hazards with this project that resulted in substantially improved controls.

Several hazard identification and analysis initiatives have reduced the risk of worker exposures to hazardous materials at CMR. During the CMR shutdown in 1998 and 1999, CMR safety and health converted existing work activity packages to HCPs. This labor-intensive process provided an opportunity for walking down and reassessing the hazards associated with CMR programmatic work. During this period, hazardous chemicals usage in numerous CMR work activities and laboratories was also evaluated. More recently, LANL established a comprehensive program for the identification and analysis of beryllium contamination (current and legacy uses) that is being rigorously implemented at CMR. The extensive characterization of the beryllium hazard at CMR included the development of a beryllium sampling strategy, the collection of more than 300 surface and air samples, extensive interviews with current and former LANL workers who may have been exposed to beryllium, and a risk-based plan for future sampling and decontamination of beryllium-contaminated areas.

However, additional focus on hazard identification and analysis programs and processes is needed in a number of areas within CMR:

- As a result of AL's removal of a baseline hazard assessment from LANL contractual performance metrics, and because of the subsequent LANL suspension of the health hazard assessment program, CMR has not maintained a comprehensive non-radiological exposure assessment strategy, sampling protocols, and a program for implementing the requirements of DOE Order 440.1A, Attachment 2, Section 18 "Industrial Hygiene." Although a CMR baseline hazard analysis was performed in 1995 as part of the sitewide health hazard assessment program, the baseline hazard analysis has not been routinely maintained, other than a 1997 update and a number of hazardous chemical evaluations that were conducted at CMR in 1998 through 1999. Exposures to ergonomic hazards, beryllium, and some reproductive toxins and high noise areas have been characterized and sampled, but CMR has not developed a comprehensive risk-based strategy or established sampling protocols for routinely assessing, characterizing, and sampling CMR work spaces and work activities for potential worker exposures. Fewer than a dozen worker exposure records were located for sampling or monitoring of noise, non-ionizing radiation, and hazardous chemicals during the past four years of CMR operations. Furthermore, CMR has not developed a plan for routinely assessing worker exposures at CMR (including "negative exposures") that is proportional to the risk presented by the hazards and consistent with guidance provided in the DOE Standard for Industrial Hygiene Practices (DOE-STD-6005-2001) or recommended by the American Industrial Hygiene Association. Exposure assessments for other stressors, such as noise, have not been adequately documented. Noise dosimetry, for example, has not been performed on workers who may be periodically exposed to high noise levels (e.g., operator technicians and NMT-11 machine shop workers) to determine whether these workers are exposed to noise levels in excess of 85 dBA, and should therefore be included into the LANL hearing conservation program. CMR is currently drafting a workplace monitoring strategy to address these concerns and has recently initiated an evaluation of the NMT-11 machine shops.

Finding: Baseline hazard surveys are not being maintained, and exposure assessments for chemical and physical hazards are not being performed as required by DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, to ensure that potential worker health risks are identified and evaluated.

- Although safe work practices constitute an effective work control process for programmatic work activities, the safe work practices process does not provide sufficient guidance to line managers to ensure that hazard identification and analysis tools are appropriately and consistently used. For example, CMR programmatic line managers lack sufficient institutional and facility guidance or "tools" to ensure identification and analysis of hazards in the preparation or revision of programmatic work documents (i.e., HCPs, work instructions, or SD-HCPs). As a result, some programmatic work, HCPs, SD-HCPs, and work instructions have not been reviewed or have not received an adequate review by the NMT safety and health team. The "triggers" for when to involve safety and health, as documented in the safe work practices LIR and NMT division instruction on HCPs, are too subjective and lack clear thresholds or guidance to be adequately or consistently interpreted, and have resulted in some work instructions bypassing a needed review by the NMT safety and health team. For example, the CMR work instruction for "Bagout of Samples and Waste" did not receive a review by ESH-1 although the work instruction directed the use of radiological control technicians (RCTs). Neither the Wing 9 machine shop work instruction nor the HCP received a review by NMT safety and health, resulting in a number of machine shop controls being missed or insufficiently described. In another example, the draft HCP for the synthesis of actinide nitrides project planning to be performed by NMT-11 involves reproductive toxins, teratogens, pyrophorics, and carcinogens, but did not receive a review by safety and health, although required by the chemical management LIR. Initially this proposed activity had been classified as a low initial risk by the originator. However, following an expression of concern by the OA team and an additional peer review by the Deputy NMT-11 group leader, the initial risk was deemed to have been categorized incorrectly. Typically, these documents require an environment, safety, and health (ES&H) review only if risk-ranked a "high initial risk activity." In some cases, the technical staff may assume "credit" for obvious controls, resulting in a lower risk ranking, as evidenced by the recent SD-HCP for helium leak testing. As a result of this concern, the CMR staff will be receiving training on the application of the risk-ranking process to programmatic work.

- Some programmatic activities are often risk-ranked as low to medium risk by the CMR technical staff based on small chemical quantities, limited exposure, or assumed controls, and therefore the appropriate hazards and controls are not identified. As a result, some controls (e.g., postings and exposure monitoring opportunities) are missed. For example, the NMT-16 arc melter involved exposure to ultraviolet radiation, but did not receive a review by safety and health to determine whether the ultraviolet radiation exposure to workers was within the guidelines established by the American Conference of Governmental Industrial Hygienists (as per LANL work smart standards), or whether the prescribed personal protective equipment (PPE) (welding goggles) was adequate. In addition, the current risk-based approach to involvement of safety and health does not adequately consider the requirements for safety and health involvement regardless of risk as required by some LIRs. For example, the "Welding, Cutting, and Other Spark or Flame Producing Operations" LIR requires an industrial hygiene review when welding on some toxic materials, regardless of perceived risk.

- The "graded risk approach" has not been sufficiently applied to ensure that programmatic activities are risk-ranked consistently. Such was the case with the NMT-11 activity for synthesis of actinide nitrides. Although some LANL tools (such as the LANL ES&H hazard identification, or ESH-ID, process) have been developed to aid workers in the identification of hazards and requirements, according to ESH-3, these tools are seldom used by the programmatic staff, or are not being effectively used. In general, line managers have not adequately incorporated the multitude of safety and health requirements that are dispersed though many LIRs, LIGs, and memoranda into programmatic work documents. The ESH-ID process provides some capabilities to identify requirements, but is not consistently used for programmatic work at CMR.

- The existing tools do not adequately ensure that aggregate laboratory hazards at the work activity level will be identified and analyzed. In most cases, HCPs for programmatic work conducted in CMR do not address legacy hazards or room environmental hazards, although such hazards may present a risk to workers. For example, although the NMT-16 HCP-001 bounds all the hazards for work activities in Wing 2, the HCP-001 hazard-screening checklist does not address several room environmental hazards in Room 2118, such as the beryllium contamination or the lead bricks in a fume hood. Furthermore, waste-related HCPs generated by NMT-7 do not address these hazards.

- Some HCPs do not adequately describe or bound hazards identified in referenced work instructions. For example, NMT-16 HCP-001 does not address all the hazards identified in the NMT-16 work instruction on "Bagouts of Sample Waste in Wing 2," such as the potential hazards associated with material handling operations. In another example, the hazard screening for the NMT-16 arc melter assigns a "medium" risk to the potential ultraviolet radiation hazard. HCP-001, however, which addresses and bounds this work activity, assigns an initial risk of "low" for this and other related ultraviolet exposure work activities.

- There is no formal mechanism or tool for evaluating the cumulative effect of multiple hazards in a location or co-located work activities. For example, for the multiple programmatic activities conducted in Room 2118, Wing 2, it is not evident that the hazards from both multiple work activities and legacy hazards have been adequately evaluated in an HCP or elsewhere.

- Other opportunities for involvement of the NMT safety and health team are missed. For example, the CMR Facility Steering Committee, which is responsible for reviewing all new programmatic activities, does not include safety and health as a voting member. Furthermore, the NMT safety and health team has not attended the most recent four meetings of the committee. In addition, the CMR Facility Steering Committee does not review SD-HCPs.

Finding: The safe work practices process does not provide sufficient guidance to programmatic line managers to ensure that hazard identification tools are appropriately and consistently used. Examples of such tools include risk ranking of programmatic work activities, incorporation of safety and health LIRs into HCPs and work instructions, involvement of safety and health subject matter experts, and use of the LANL ESH-ID process.

The OA team identified two potential hazards that were not adequately analyzed, but were covered by HCPs. For example, during a recent (March 2002) event, NMT-7 workers failed to identify and analyze the new hazards associated with the inspection and repackaging of legacy waste in CMR Wing 4, resulting in a personnel contamination. Workers did not conduct effective pre-job planning for a non-routine operation, used an existing HCP, and did not recognize the new hazard resulting from the potential for freestanding liquids in waste that contained cesium (Cs-137). The contamination incident occurred during an NMT-7 waste handling activity to repackage legacy waste boxes from a 1997 NMT-11 Wing 9 Hot Cell decontamination activity. The HCP for normal waste operations was utilized for this activity. However, the potential for freestanding liquids was not expected or analyzed, although dried water stains were identified on some of the boxes, and the work instructions included precautions to take if unidentified liquids were found. Prior to this incident, approximately 150 boxes of waste from this stream had been processed without a problem. No radiation work permit (RWP) was generated for this activity since the controls in place for the routine waste operations work instructions were considered to be adequate. Had additional hazard analysis been performed upon discovery of the stained boxes and the HCP and/or RWP been modified to account for the new hazards, it is likely that additional controls would have been implemented and the contamination event might have been avoided.

Summary

Overall, the hazard assessment integrated into the procedure development/revision process for RLWTF operations activities and the AHA and the ES&H site hazard and control processes for RLWTF and CMR maintenance activities are effective tools for analyzing hazards. In addition, the processes for the identification and analysis of hazards for programmatic work are well established at the institutional level through safe work practices, and in CMR through the facility approval process, HCPs, and work instructions. Processes for reviewing new or changed programmatic work with respect to the CMR authorization basis are rigorous and effective. Hazard identification and reduction programs in a number of areas are robust, such as the beryllium program and the removal of legacy hazardous chemicals from CMR.

However, additional focus is needed in a number of hazard identification and analysis areas at CMR for programmatic work. For example, CMR lacks a comprehensive non-radiological exposure assessment strategy and sampling protocols. Sufficient guidance or "tools" have not been provided to line management to ensure an appropriate and consistent identification and analysis of hazards. Some HCPs and work instructions did not adequately or consistently address some hazards, such as legacy hazards, and there is no formal mechanism for evaluating the cumulative effect of multiple low-risk hazards. In addition, a few hazards at CMR were not adequately identified or analyzed.

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

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

RLWTF Operations

Waste Facility Management (WFM) issued a written policy on conduct of operations in March 2002 as part of conduct of operations implementation. The document addresses the WFM policy regarding each chapter of conduct of operations addressed in the DOE order. These recently issued policies have not reached the workers in all cases. The policy does address procedure compliance and states that procedures are used for training and onsite reference. It also provides some direction on procedure use, such as a requirement to keep hardcopies of procedures at the job site. However, it provides no expectations on field use of procedures or how procedures are to be used in the training environment. Currently, operators rarely use the procedures in-hand in the facility.

As discussed under Core Function #2, RLWTF has implemented a strategy for operations procedure development that integrates controls resulting from the HCP directly into the procedures. The controls are placed in cautions, warnings, or action steps directly associated with the activity steps where the hazards are encountered. This application of the safe work practices requirements to operational activities and the approach to operational hazard control are noteworthy in that safety is fully integrated into the instructions used by the operators to perform work.

Training for operations personnel was up to date and effective in ensuring that personnel only perform tasks for which they are qualified. Training topics were appropriate, and tracking systems were current and accurate. Operators were trained and qualified for the observed job tasks.

Most current operations procedures at RLWTF are inaccurate and of poor quality, and have not been revised in years. For example, the hard alarm response procedure was written in 1997 and provides only generic response guidance (mostly administrative) to most of the plant hard alarms. The procedure does not provide any predetermined response actions for specific plant alarms and only limited diagnostic guidance for hard alarms associated with the LANL-wide collection system leak detection alarms. The procedure contains an out-of-date callout list from 1997 for after-hours alarms. A current list is posted at the facility and provided to the central alarm station, but the procedure is not routinely revised to update this list, and should not contain a list of this type. In another example, temporary effluent tanks were installed in 1999 and have been in use since then for authorized discharges. However the discharge procedure was never revised to reflect use of these tanks or the associated valve lineup.

A procedure upgrade project is ongoing, and the procedure development process is detailed and rigorous. However, progress over the last two years has been slow. For example, only one out of the nine main treatment operations chapters (Sampling) has been issued, although development of these chapters started as early as March 2000. The facility has also not been successful at maintaining the ITSRs up to date, as previously identified in an internal technical safety requirement assessment report performed in June 2001. Management has taken some positive steps to improve procedures and other conduct of operations issues. LANL incorporated DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities,* into its contract in 2001 and issued an implementation plan for conduct of operations on August 15, 2001. While RLWTF has made some progress in implementing the additional requirements, facility implementation is significantly behind schedule. The gap analysis between RLWTF and the order was scheduled to be complete by October 31, 2001, with verification beginning November 1, 2001. At the time of the assessment, RLWTF conduct of operations program implementation was approximately five months behind. The gap analysis was awaiting OLASO Facility Representative approval, and verification had not begun.

Through internal and external assessments, LANL has identified lack of operations procedures for safety-significant systems and equipment as a LANL-wide systemic weakness. For example, as discussed in

Appendix F, procedures currently do not exist at CMR for a majority of safety-significant systems and equipment, nor are alignment checklists or other instructions sufficient to guide operators in establishing and maintaining correct systems and component configurations.

Finding: CMR does not have adequate procedures for operation of many safety systems and safety-related equipment and thus cannot adequately assure that systems and equipment are always configured correctly and operated in accordance with ISM and conduct of operations requirements. Furthermore, RLWTF management has not yet established and sufficiently enforced clear expectations for the development and use of procedures for facility operations. Many procedures have not yet been developed, most existing procedures are of poor quality or are not current, and procedures are often not used or followed in the RLWTF.

Postings at RLWTF were also deficient. Several postings were inaccurate, out of date, or not being followed. Many of these deficiencies were immediately corrected; however, the number of deficiencies indicated a lack of rigor in compliance with posted controls.

RLWTF Maintenance

RLWTF has detailed administrative procedures for work control. These procedures cover the requirements for planning and performing maintenance work in these facilities and implement the LIRs related to facility management. Training for maintenance personnel was up to date and effective in ensuring that personnel only perform tasks for which they are qualified. Training topics were appropriate, and tracking systems were current and accurate. Maintenance workers were trained and qualified for the observed job tasks. Senior JCNNM management is committed to ensuring that workers have completed required training on schedule. For example, a performance metric is in place for the JCNNM contract regarding the contractor's ability to ensure that individuals successfully complete training qualifications each year. Training class "no shows" by JCNNM employees is efficiently tracked and addressed to ensure qualifications are successfully completed. As a result, the crafts have a clear understanding from managers that training is not to be missed without sufficient reason.

An extensive effort to update and certify RLWTF electrical as-built drawings is nearly complete. Facility Waste Operations - System Engineering and Maintenance is currently completing its QA review of the final product and should be providing the updated drawings and equipment data sheets to the RLWTF facility engineer soon. This effort will be consolidated with the even larger as-built update effort conducted by RLWTF in September 2001 on its mechanical and new construction project drawings and plans. These efforts will result in a much more accurate and comprehensive baseline for configuration management if weaknesses in maintaining configuration control (discussed below) are promptly addressed.

LIR 240-01-01.2, "Facility Configuration Management," provides institutional-level requirements for facility configuration management programs; however, the work control process at RLWTF does not provide sufficient detailed requirements to ensure that appropriate documents, drawings, and procedures are updated for facility modification performed under a maintenance work package. Specifically, the work control procedure allows for the facility coordinator to close out the work package and then to address configuration management changes and updates. Because the work package is closed out, the procedure has taken away any drivers to complete the configuration management updates. In addition, the procedure assigns the responsibility for configuration control to the "cognizant system engineer." However, that function has not been assigned to any individual at the facility, and facility personnel have differing opinions as to who is currently performing the configuration management functions. While the work control procedure includes the process for describing conditions that require configuration management controls (e.g., for updated drawings), RLWTF has not adequately implemented those steps as they are described in the procedure. There is a lack of clear roles and responsibilities for configuration management responsibility for modification work packages and new construction. Consequently, facility configuration control on new work packages is not assured or effective. RLWTF management recognizes the configuration management problems and intends to address them in the next work control revision. The facility is also in the process of hiring a maintenance engineer whose duties will include configuration control.

Finding: The work control process at RLWTF does not ensure that appropriate documents, drawings, and procedures are updated for facility modifications performed under a maintenance work package.

CMR Maintenance

CMR has a detailed administrative procedure for work control. This document specifies the requirements for planning and performing maintenance and construction work and implements the applicable LIRs. The CMR work control document has detailed instructions for work package development, which include specific responsibilities of personnel related to work control and designation of different types and levels of work using a graded approach.

A fundamental part of developing work packages is the development of the AHA and ES&H site hazard and controls. This development process involves lead planners, systems engineers, ES&H professionals and the work providers. These processes are effective in identifying controls associated with identified hazards of maintenance activities. Review of 30 work packages in CMR indicate that appropriate controls, such as permits for confined space entry, lockout/tagout, RWPs, and training requirements, were specified and documented in the work package and fully supported the AHA.

CMR management fully recognizes the importance of proper training and qualification to assure safe, efficient performance of maintenance and operations. Crafts personnel were properly trained and qualified to perform their functions. In addition, the crafts exhibited outstanding skills and pride in their work. The importance of establishing the proper safety perimeter by using the lockout/tagout process was performed effectively in all cases except one, in which a blower was not properly locked out before work in a ventilation plenum.

The most significant weakness related to implementation of controls was the failure to maintain work package configuration control. CMR does not have a rigorous document control system to ensure that the craft personnel are working with an up-to-date copy of the work package. For example, a ML-2 priority (LANL uses a four-level prioritization system to categorize high safety significance, with ML-1 the most safety significant and ML-4 the lowest safety significance) glovebox job was being performed without several approved field change requests available to the workers. Personnel had made copies of different parts of the work package for their own use, but no complete record copy was being maintained. Because there is no specifically identified “official” or “record” work package and copies are made of parts of the work package by different personnel, it becomes very difficult for supervision and management to determine what items constitute a complete package after initial issue. Because some packages are worked for weeks at a time and a number of changes may be issued during that time period, the problem with maintaining a record copy becomes more difficult. This problem is exacerbated by not having a checkoff sheet for the lead planner when initially assembling work packages. The lead planners indicated that they generally use the work package coversheet as the checkoff for package completeness, even though there are a number of forms required by the work control document to be in the package that are not listed on the work package cover sheet. Many packages contain work for different crafts, which tends to break up the package and make it very difficult to understand the overall status of the work package. No indicators (e.g., record copy or official copy stamps, or distinctive color of paper) are used to distinguish record copies from copies of documents. This results in many completed packages having multiple signoff pages, many of which are not completely filled out. The potential for problems in implementing controls and performance of work is significantly increased by the lack of a document control system. Following this observation, the CMR maintenance manager put a hold on all active work packages until they could be reviewed for accuracy and completeness. CMR management personnel recognize the weaknesses in work package documentation as a significant problem and are taking action to achieve configuration control of the work packages.

CMR Programmatic Work

Processes for the development and implementation of hazard controls for programmatic work are well established at the institutional level through safe work practices, and at CMR through the facility activity approval process, HCPs, work instructions, permits, postings, and training provided to the technical staff. Implementation of controls at CMR is provided though engineering controls, administrative controls, and PPE.

Engineering controls for programmatic work at CMR are extensive and include fume hoods, gloveboxes, room ventilation systems, local ventilation systems, and two banks of hot cells located within Wing 9. Engineering controls provide the primary mechanism for controlling hazards and were generally robust, effective, and adequately maintained or tagged out if not in service.

The CMR radiological control program is comprehensive and effective and has a sound technical basis. At CMR, the Health Physics Operations Group, ESH-1, maintains a comprehensive program of routine radiological monitoring and surveillance activities. Additionally, an aggressive approach to the establishment of radiological control boundaries, and self-survey stations at CMR serve as an effective means of identifying contamination prior to exiting radiological areas. ESH-1 has also developed sound technical basis documents for both the routine radiological monitoring and air sampling and monitoring at CMR.

Training records for some CMR programmatic work activities indicate that the identification and implementation of training requirements for programmatic work are thorough and consistent with the hazards identified. For example, the Chemistry – Actinide Analytical Chemistry (CAAC) QA organization has developed a formalized group-training plan that identifies and tracks training requirements commensurate with the work activity. Similarly, on-the-job training plans, when used, were comprehensive and formally documented for each employee. Furthermore, line managers within CMR consistently verify training requirements prior to the commencement of new work.

The CMR chemical inventory is also aggressively managed and monitored by the CMR hazardous materials manager. Chemical inventories are routinely updated as chemical quantities change. A number of innovations unique to CMR have improved the tracking of chemicals, and the communication of chemical hazards to CMR workers.

The CMR HCP process and the development and use of work instructions as defined in the NMT "Document Development and Control" procedure are effective and comprehensive methods for the identification and control of programmatic hazards. Work instructions generally provide a clear description of hazards and related controls. For example, the CAAC work instruction on receipt of analytical samples includes a comprehensive description of hazards, cautions, and associated controls.

Although administrative control processes, such as the HCP and work instruction processes, are well established, the controls specified in some HCPs and work instructions lack the level of detail to be adequately implemented or the controls in work instructions are less specific than the controls identified in referenced LIRs. Some work instructions are not adequately referenced or reflected in an HCP. For example, the NMT-16 division work instruction for "Bag Outs of Samples and Waste in Wing 2" references HCP-001, but HCP-001 does not address bagouts of waste. Furthermore, neither the bagout of samples nor the associated work instruction is referenced in HCP-001. Some required controls are not identified in work instructions or HCPs. For example, the local ventilation system in the Wing 9 designated welding area is not identified as a control in the machine shop HCP or work instruction, although the control is required to mitigate the hazard. In another example, the arc-welding hazard control (i.e., welding goggles) is not identified in NMT-16 HCP-001, although the control is discussed in the work instruction. When HCPs and work instructions are used in lieu of LIRs to define hazard controls for the same work scope, the definition of controls in the HCP/work instruction is often less specific than the level of definition typically provided in the LIR. For example, the Wing 9 machine shop HCP and work instruction do not have a comparable level of detail in requirements for welding, grinding, and cutting and shop operations as the LIRs for these topics.

PPE is not clearly specified for some hazards in HCPs and particularly in work instructions. For example, PPE for some machine shop and welding operations in the Wing 9 machine shop, although identified in work instructions, lacked the specificity to be correctly and consistently implemented. Welding operations did not identify the difference in welding PPE required for stick welding, tungsten inert gas (TIG) welding, or oxyacetylene welding, or when flame retardant clothing was required. PPE requirements for welding, grinding, and cutting operations in the Wing 9 machine shop are not clearly defined in either the machine shop work instruction or the HCP.

Aggregate hazards and control measures in laboratories are not adequately communicated to workers via such mechanisms as door postings. Many CMR laboratories contain both process hazards and some legacy hazards, although CMR facilities management has aggressively sought to eliminate most legacy chemicals and equipment. Neither LANL nor CMR has provided clear, consolidated guidance for labeling of laboratory doors with respect to room and/or process hazards and controls, although a work instruction on laboratory postings is currently being drafted by NMT. Most CMR technical staff are well aware of the hazards associated with their projects. However, they are less aware of the hazards associated with other projects conducted in their vicinity, or of the potential legacy hazards from former projects. The lack of clear and accurate postings inhibits hazard communications to infrequent laboratory occupants (e.g., maintenance, custodial workers, and visitors). Although a number of LIRs address posting requirements (e.g., chemical management LIR), some CMR laboratories are not posted in accordance with these LIRs (e.g., Category I chemicals).

As discussed under Core Function 2, the identification of hazard controls and the involvement of the NMT safety and health team in the establishment of controls are based on the perceived hazard risk ranking as low, medium or high. As a result, some hazard controls that are not risk-based and are most familiar to safety and health subject matter experts are not identified or implemented. For example, according to the LIR on welding, cutting, and brazing, welding on cadmium or lead pipe requires an industrial hygiene evaluation regardless of perceived risk. However, this administrative control is not identified in the machine shop HCP or work instruction. Furthermore, the NMT safety and health team has not sufficiently evaluated some programmatic work activities or work areas to ensure that controls are adequately prescribed. For example, although hearing protectors are available for CMR Wing 9 machine shop operators, the requirements for hearing protection use are not specified in work instructions, and comprehensive sound level surveys (including noise dosimetry) of the machine shop had not been performed prior to this OA inspection. NMT-11 is currently evaluating the machine shops and revising HCPs and work instructions accordingly.

Some RWPs for higher-hazard work activities are not adequately tailored for the work activity. For the offsite source recovery at CMR NMT-11 (CMR Wing 9, east bank hot cells), the RWP does not adequately address the PPE or RCT job coverage requirements for all phases of work that may be conducted under this RWP. Although the RWP is prescriptive concerning PPE for activities such as initially opening the drums by hand, the RWP does not adequately address the PPE requirements or RCT coverage requirements for activities other than the initial drum opening. The work scope addressed by the RWP also provides for reentry into the cell corridor if manipulator problems are encountered, up to and including activities that may require hands-on work. This type of activity could include the removal of a shield plug or an inner source container. However, neither the RWP nor the intermittent RCT coverage would be adequate for this type of work, and air sampling may need to be conducted to confirm that no contamination has resulted in airborne activity and continuous air monitors (CAMs) may be required.

Workplace indicators for some contamination events are not adequately used. Bioassay instrumentation and methods used at LANL provide a degree of detection and sensitivity for plutonium that is considerably better than at many other DOE sites. In addition to routine bioassay sampling, various "triggers" have also been put in place to detect intakes of 100 mRem or greater as required by 10 CFR 835. These triggers provide workplace indicators and monitoring results and the accompanying bioassay action indicators include air monitoring results tied to derived air concentration (DAC) hour assessments, CAM alarms, positive nasal smears, facial contamination, wound contamination, and routine bioassay results. However, LANL and CMR procedures do not specify the use of workplace indicators for certain contamination events as a potential indicator of 100 mRem potential exposure. These indicators could include significant levels of contamination detected on protective clothing or the unplanned spread of contamination on accessible surfaces. The additional use of such indicators would be consistent with the guidance in DOE Standard, Internal Dosimetry (DOE-STD-1121-98, December 1999).

Finding: For programmatic work, hazard controls are not sufficiently defined or adequately implemented in several areas: controls in HCPs and work instructions lack the level of detail to ensure effective implementation and are often inconsistent with similar controls specified in LIRs; PPE is not clearly specified for some hazards; aggregate hazards in laboratories are not communicated to workers (e.g., door postings); some RWPs are not adequately tailored for the work activity; and some radiation contamination workplace indicators are not adequately considered.

Summary

Overall, controls are established and implemented for recognized hazards for CMR maintenance and RLWTF maintenance and operations. Processes for the development and implementation of hazard controls for programmatic work are well established at the institutional level through safe work practices, and at CMR through engineering and administrative controls and PPE. Engineering controls for programmatic work, such as fume hoods, gloveboxes, and hot cells, are effective and are adequately maintained. In general, administrative controls at CMR are thorough and consistent with the hazard identified. CMR radiological control, training, and chemical management programs are particularly effective in identifying and implementing controls at the work activity level.

However, some controls, such as operations procedures, postings, and work instructions, are not current and/or complete enough to support RLWTF operations and maintenance and CMR maintenance. The lack of adequate procedures is a particular concern, and progress to address it has not always been timely. Furthermore, for programmatic work in CMR, administrative controls identified in some HCPs and work instructions lack sufficient definition to be effectively implemented. PPE is not clearly specified for some hazards, and the lack of formal guidance for hazard and control postings on laboratory doors has inhibited hazard communications. In addition, some RWPs are not sufficiently tailored to the work activity, and radiological workplace indicators are not adequately used. Increased attention is needed to ensure that effective controls are current and available for the workers.

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

Readiness is confirmed and work is performed safely.

RLWTF Operations

Operators are cognizant of the predominant hazards associated with RLWTF operations and are aware of the radiological, chemical, and physical hazards encountered in routine and non-routine operations. The operators are experienced and knowledgeable of the facility, facility hazards, and the appropriate controls for eliminating or mitigating those hazards. Workers are empowered to stop work if an unsafe condition is identified and are not hesitant to invoke their stop-work authority.

Plant conditions are discussed between operations and engineering personnel before plant operations are authorized each day. In some cases, operating plans are developed by engineering and approved by facility operations management when specific treatment regimens are to be used. Operations are only performed when authorized by the treatment operations supervisor or above.

Although most operations were performed in accordance with approved procedures, a few cases were identified where operators did not perform the procedure as written. For example, operators did not perform several steps as written in the National Pollutant Discharge Elimination System sampling procedure. The sampling procedure is the only approved procedure issued under the new format and was issued in June 2001. However, sampling practices have changed since the procedure was issued, and the procedure has not been revised to reflect the new practices. In another example, operators have been using temporary effluent tanks (Frac tanks) for authorized discharges since 1999; however, no procedure exists to align these tanks to the discharge path. Procedure compliance has not been an area of significant management focus (at CMR as well as RLWTF, see Appendix F), and operators do not demonstrate ownership of or confidence in the procedures. Increased vigilance by facility managers and supervisors is warranted to ensure improvement.

RLWTF Maintenance

The RLWTF organization is effective in ensuring that appropriate controls are in place prior to authorization of work. The facility coordinator assigns and approves all work. In addition, pre-job briefs are effectively used to ensure that workers are knowledgeable of hazards prior to the start of work activities. In the pre-job briefs, the crafts and foremen displayed the understanding of their responsibilities to work safely. The foreman and crafts also displayed extensive knowledge of and experience in the facility.

The access and visitor control system is another effective control for authorizing work and protecting individuals from unescorted access to hazard areas. Non-resident and resident craft are required to report to the facility coordinator prior to start of work at the facility. Crafts personnel demonstrated a willingness to adhere to this policy and on many occasions delayed work while the facility coordinator ensured that appropriate training and documentation were in place prior to starting work or starting the next task. When multiple tasks are included in a single work package, the facility coordinator may require a work hold point so that the workers can notify the facility coordinator when they are ready to start the next task, such as a blind penetration into a concrete wall.

Observed work was generally performed safely and within the established controls. Workers and supervisors were cognizant of the predominant hazards associated with the work they were performing. When controls were determined to be inadequate, work was stopped until the controls were corrected. For example, during a job involving repair of a demineralizer tank, workers at RLWTF discovered that the tank was heavier than expected even after draining the tank. They stopped the job, and the JCNNM zone supervisor and the foreman modified the work package to address the newly identified hazards by use of a dolly and a hoist. The supervisor then verified the workers' training in incidental hoisting and rigging prior to resuming the job.

CMR Maintenance

CMR ensures that effective controls are in place prior to authorization of work. CMR has two mechanisms to ensure that work is authorized and the proper safety envelope is set. The first is authorization by the POD and the second is authorization by the Operations Center, which is also effective in maintaining cognizance and control of work activities. The resident and non-resident crafts adhere to the policy of getting work on the POD and then receiving authorization from the Operations Center prior to performance of work.

Pre-job and pre-shift briefs are for the most part effectively used to ensure that workers are knowledgeable of hazards prior to the start of work activities. The pre-job and pre-shift briefings attended were properly conducted and covered all activities and hazards associated with the job in accordance with the work control document. Work packages designated as ML-1 or ML-2 contained sufficient evidence that pre-job/pre-shift briefings occurred as required by work control procedure. The packages included a checklist, signoffs of the supervisor conducting the briefings, and workers signing that they understood the job and potential hazards as described in the briefings.

Even though most of the work observed was performed within controls, some problems exist with workers not following established controls. Two of the pre-job briefs observed did not have the material required to perform the job, which was in violation of the administrative requirements. In addition, all required personnel were not in attendance, and a number of pre-job briefs had to be rescheduled due to lack of attendance. Pre-job briefs are normally conducted in the JCNNM area adjacent to one of their grinding and welding work areas. When crafts personnel are grinding, the noise level is excessive. Other problems in the performance of work involved crafts personnel failing to comply with work instructions. A work package for removal of 200 linear feet of asbestos in Room 2295 specified personal air sampling. Workers, without approval of CMR management, lined through the specified air sampling requirements and marked them "void" because the work was in a radiation area. Craft personnel stated that the reason for voiding the requirement was the perception that they would have to turn over their personal air samplers to radiological control personnel if they were worn and operated in a radiation area. Radiological control personnel indicated that this was not correct and that they could release the air samplers based on air samples and contamination surveys. In another example, craft personnel were installing float control valves in a ventilation enclosure while the blower was operating on low speed. Although the craft instruction specified that blower should be off during work in the plenum, the workers failed to lock out the blower prior to starting work.

CMR Programmatic Work

Processes for ensuring the safe performance of programmatic work are established at the institutional level through safe work practices, and at CMR through the facility activity approval process, HCPs, work instructions, readiness reviews, and other work authorization processes.

Work authorization and readiness review processes in CMR for new work and resumption or restart of ongoing work is extensive, and typically involves multiple reviews. Work authorization for new work in CMR requires the completion and signoff of a 21-step process defined in the CMR activity approval process procedure. For example, this process was rigorously followed prior to work authorization of the high temperature solution colorimetric work performed by NMT-16 in Wing 2. In another example, the readiness assessment process for resumption or restart of work for the CMR Wing 9 West Bank Hot Cell was thorough and included participation from appropriate managers, staff, workers, and subject matter experts.

Programmatic work observed by OA team members was performed in accordance with controls as specified in HCPs and work instructions. For example, analytical sample receipt and distribution performed by the CAAC staff in Wing 5 implemented all engineering and administrative controls as prescribed in work instructions. Work conducted for the unpacking and surveys of materials for offsite source recovery was performed in strict compliance with the work plan and radiological controls established. Adherence to work practices for calorimetric work conducted in Wing 2 was aided by an "Operations Manual" created to assist staff in performing work safely.

Programmatic work at CMR is performed safely, as evidenced by injury and illness rates that are below DOE complex averages for comparable work activities. However, some poor radiological work practices have resulted in contamination events, as evidenced in recent radiological incident reports. Although significant attention has been given to the area of radiological contamination control at LANL and specifically CMR, poor radiological work practices continue to be a major contributor to the frequency of radiological contamination events as captured by the radiological incident reports for CY 2001 and 2002 at CMR. LANL and/or CMR has undertaken actions to increase the focus on contamination control, including measurement tools (tracking and trending), additional communication to the workforce, and reporting of contamination incidents below the threshold for reporting to the Occurrence Reporting and Processing System. At the sitewide level, Appendix F measures on radiation protection were expanded from dose and intakes to include contamination control. In response to concerns expressed by DOE and NNSA, CMR has implemented numerous corrective actions, as well as voluntarily suspending operations for a short duration until a CMR-specific Radiation Protection Supplemental Plan could be issued. Because an improvement of worker radiation control practices will most likely directly relate to lowering the frequency of these events, the facility's initiative to increase line management review of radiological performance data and use of behavior-based safety observations is an appropriate step. However, line management review needs to remain an ongoing effort in the areas of radiological assessment, data analysis, and the communication of expectations to the workforce.

Summary

Overall, CMR and RLWTF facility maintenance, operations, and programmatic work is performed within established controls and workers understand the site hazards and the importance of strict procedural compliance. Workers indicated that they felt empowered to stop work if safety concerns arose. However, some instances were observed where workers failed to comply with procedures or work instructions. Increased management attention is needed to ensure the expected rigor of procedure or work instruction compliance.

E.3 CONCLUSIONS

CMR and RLWTF maintenance and RLWTF operations are characterized by generally strong mechanisms for implementation of the core functions, with most of these mechanisms working effectively. Work scopes are adequately defined, hazard identification and analysis processes result in effective controls in most cases, observed work was performed in accordance with the controls, and mechanisms are generally in place for workers to provide feedback and improvement. However, isolated problems exist, and increased management attention is needed to ensure that these problems are promptly resolved.

At RLWTF, the facility is changing at a relatively rapid pace. For the last few years, the facility has continually installed new equipment and modified treatment methodologies to reduce discharges and optimize plant performance. In the same period, RLWTF management has committed to use of standards-based procedures. RLWTF has established a potentially effective procedure system that integrates hazard analysis into the procedure development process and the resulting controls directly in the procedure. However, RLWTF management has not provided adequate expectations regarding use of procedures; therefore, workers still do not perceive the need to strictly follow procedures. When new modifications are installed or treatment methodologies change, facility personnel do not always revise the operating procedures. Consequently, the existing procedures are not kept current and become increasingly inaccurate over time. In addition, progress in upgrading procedures to the new format has been slow due to limitations in procedure-writing resources. Similar problems exist with configuration control at RLWTF. Vague configuration control requirements in the work control procedure result in modifications being installed without proper updating of controlled documents, such as drawings. Workers do not perceive the need to strictly follow the work control procedure, so the procedures generally are never corrected.

In CMR, the work control system for maintenance is sound. However, facility management has not enforced rigorous control of approved work packages and field change requests. In one example, this resulted in workers performing work without the latest and complete work instructions available and performing some work tasks not in the approved work instructions. Management is developing long-term improvements to the work package control process.

Overall, the safe work practices LIR and LIG provide adequate and user-friendly guidance for how programmatic work should be defined. Programmatic work at CMR is generally performed safely and implemented in accordance with the LIRs and LIGs, as evidenced by CMR's implementation of HCPs, and facility activity approval processes. However, improvements are needed with respect to implementation of safe work practices in the following areas: line management does not have sufficient tools to ensure that hazards are identified and adequately analyzed; some hazards are not sufficiently identified or analyzed to ensure or validate that worker exposures are within prescribed limits; and there are deficiencies in laboratory room postings, specification of PPE, and the identification of controls in some HCPs and work instructions.

E.4 RATING

The ratings of the first four core functions reflect the status of the reviewed elements of the ISM programs at RLWTF and CMR.

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

E.5 OPPORTUNITIES FOR IMPROVEMENT

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

1. **Strengthen and enforce the LANL institutional and facility policy and expectations regarding use of operations procedures and work instructions.**
    - Provide specific instructions on when in-hand use of a procedure or work instructions is expected, such as when an evolution is infrequently performed, or anytime a worker is not completely sure of the steps in the procedure. Consider establishing a list of activities that always require in-hand use of procedures.
    - Provide specific instructions that work is not to be performed without an approved procedure. Ensure that workers understand that procedures are to be performed in the sequence they are written unless otherwise stated in the procedure. Also ensure that instructions require that inadequate procedures be revised before the work is performed.

2. **Strengthen and clarify RLWTF configuration management roles, responsibilities, and requirements with regard to construction and facility modifications.**
    - Revise the RLWTF work control procedure to clearly delineate configuration control responsibilities and specific steps to ensure that the appropriate documents are revised.
    - Ensure configuration management accountability by requiring all document revisions to be complete prior to closing out the work packages in the automated work control system.

3. **Continue to make improvements in maintenance planning and scheduling, document control, and conduct of maintenance in CMR.**
    - Develop time and resource estimates for all work performed in CMR. Such estimates would allow the development of performance metrics. Performance metrics would result in improved efficiencies and allow the development of goals and objectives for eliminating the maintenance backlog.
    - Establish an effective mechanism to ensure configuration control of work packages in CMR. Accurate and complete work packages are essential to implementing and performing work with proper controls. This would also significantly improve the closure process and archiving of documents.
    - Develop mechanisms to assure that all maintenance work performed in CMR has the same rigor as related to detailed instructions and meeting the requirements of the work control instruction. (Presently technicians from the 'Group' and external crafts do not meet the same requirements as the crafts personnel assigned to CMR.)

4. **Establish sufficient guidance for performing facility-level exposure assessments, consistent with the requirements of DOE Order 440.1A.**
    - Revive the former health hazard assessment, or a comparable user-friendly hazard inventory system, to define the physical and chemical hazards throughout each facility.
    - Develop an exposure strategy for sampling and monitoring potential worker exposures to the health hazards identified in the health hazard assessment. Consider guidance provided in the DOE Technical Standard for Industrial Hygiene Practices, or other established protocols, such as those developed by the American Industrial Hygiene Association Exposure Assessment and Strategies Committee.

- Integrate medical into the exposure assessment program.

5. **Provide additional tools for programmatic line mangers to identify safety and health requirements and to recognize thresholds for involving safety and health subject matter experts.**
   - Include a safety and health team representative on Facility Steering Committees.
   - Develop safety and health screening guides for line managers to aid them in defining the type of activities for which the safety and health team should be consulted, and the type of information required by the safety and health team to effectively perform their function.
   - Evaluate the LANL ESH-ID process as a tool for defining safety and health requirements.
   - Critically assess the value of the current "risk-based" method for determining the involvement of ES&H in new or revised work activities.

6. **Improve LANL processes for collecting and communicating hazard information to workers.**
   - Develop sitewide guidance for posting hazard and hazard control information on laboratory doors.
   - Following the medical/ESH-2 initiative, pursue the development of an automated job demands checklist for managers and employees to complete on an annual basis or if job demands change from reassignments or similar actions. This information would be useful for a variety of reasons, including an opportunity for managers to discuss hazards in the workplace with employees, verification of required medical surveillance examinations, identification of potential gaps in exposure assessment activities, and an updated annual review of hazards encountered by the staff.
   - Determine methods for informing workers of environmental or room hazards, such as legacy waste and co-located projects with multiple hazards.

7. **Provide additional workplace indicators and triggers for special bioassays for certain contamination events as potential indicators of 100 mRem potential exposure, consistent with the guidance contained in the DOE Standard for Internal Dosimetry (DOE-STD-1121-98, December 1999).**
   - Develop indicators that include significant levels of contamination detected on protective clothing or the unplanned spread of contamination on accessible surfaces.
   - Conduct a review of current LANL and CMR bioassay procedures for consistency with the expectations and techniques outlined and discussed in the DOE Standard for Internal Dosimetry (DOE-STD-1121-98, December 1999), and DOE Standard, Guide of Good Practices for Occupational Radiological Protection in Plutonium Facilities (DOE-STD-1128-98, June 1998).

APPENDIX F

Essential System Functional Review

F.1 INTRODUCTION

As part of its review at Los Alamos National Laboratory (LANL), the U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) performed an essential system functional review. The purpose of an essential system functional review is to evaluate the functionality and operability of a facility's systems and subsystems essential to safe operation by performing a technically focused evaluation of a representative sample of one or more systems. The review criteria were similar to the criteria for the Defense Nuclear Facilities Safety Board Recommendation 2000-2 implementation plan reviews; however, this review also included a review of selected portions of system design and the adequacy of the authorization basis.

The systems selected for this review were the Chemistry and Metallurgy Research (CMR) building fire suppression and ventilation systems. The fire suppression system was selected because it is the only system designated as safety-class in the basis for interim operation (BIO). The ventilation system, designated as a safety-significant system, was also selected because of its importance in the BIO to accident mitigation. The safety functions of the fire protection systems are to extinguish fire and ensure that sufficient water is available to the fire department. The safety function of the ventilation systems is to prevent the release of radioactive materials through active and passive design features and associated procedures. The review focused on four topics: configuration management, maintenance, surveillance and testing, and operations. Specific areas of review included the authorization basis (including the technical safety requirements), the facility and procedure change processes, conduct of operations, engineering products such as modifications and calculations, corrective and preventive maintenance, operations procedures, surveillance testing, and personnel training and qualifications. The review determined the effectiveness of the responsible organizations in establishing and maintaining the systems' ability to perform their safety functions. OA inspection techniques included interviews, technical discussions, review of applicable procedures and other documents, field inspections of system hardware, observations of facility activities, and review of the technical quality and procedural compliance of the organizations' output documents.

F.2 RESULTS

F.2.1 Configuration Management

Configuration Management is divided into several review areas, including authorization/safety basis, the unreviewed safety question (USQ) program, the design change process, the review and comment process, equipment identification and tagging, drawing control, the root cause and corrective action program, and calculations. These areas are discussed below.

Authorization/Safety Basis. The authorization/safety basis, including the BIO and the technical safety requirements (TSRs), in most instances adequately document the safety functions, roles, and performance requirements in detecting, preventing, and mitigating analyzed events. The analyses of normal, abnormal, and accident conditions for the subject systems are, in most cases, clear and adequately documented, and contain appropriate inputs, assumptions, methods, and levels of detail. However, as discussed below, there were three aspects of the authorization basis—wildland fires, high efficiency particulate air (HEPA) filter differential pressures, and uranium hexafluoride operations—that were not fully or adequately analyzed.

The BIO accident analysis does not include the threat of wildland fire as a credible external event that could cause a fire at CMR. Given the recent experience of the Cerro Grande fire at LANL and the threat that a similar fire would pose to the facility, this scenario is credible but has not been addressed in the BIO. The Cerro Grande fire was carried by very high winds, with embers blowing a mile or more across the fire lines. The fire spread toward the Los Alamos National Laboratory, and fires spotted onto the facility's land. The LANL Office of Authorization Basis has not provided direction to add this scenario to the accident analysis and the wildland fire accident scenario is not in the current BIO Update Plan.

Additionally, the potential for degrading the Technical Area (TA)-3 water inventory as a result of a wildland fire is also not addressed in the BIO. At one point during the Cerro Grande fire, Los Alamos County exhausted portions of their water supply. To supplement their inventory, water was taken from the LANL water tanks via fire hydrants connected to the LANL grid. Although the pressure in the LANL fire mains was not compromised, the water inventory was degraded. The exact extent of this inventory degradation is uncertain.

Finding: The CMR accident analysis in the BIO does not address the threat of wildland fire or its potential effect on the TA-3 water supply.

The current TSR basis guidance for evaluating wing ventilation HEPA filter degradation by using differential pressure information is not technically sound. The TSR basis requires a comparison between current HEPA differential pressure readings and the initial readings taken when the filters were installed. As the filters become increasingly loaded over time, such comparison would become indicative only of a gross failure of the HEPA. Currently, the HEPA filter daily differential pressure readings are not being trended to detect small degradations that could result in filter efficiency below the required levels.

The BIO discusses one of the processes authorized for Wing 5 that involves uranium hexafluoride. However, neither the BIO discussion nor the hazards analysis discussion adequately addresses the hazards associated with this material, particularly the hazards to the facility workers.

USQ Program. The USQ program in the CMR facility is mature. The USQ procedures are mostly clear, concise, well written, and in compliance with 10 CFR 830. A review of the documentation for approximately 20 cases in which the USQ process was entered revealed a high level of compliance with the procedural requirements. The USQ packages that were reviewed were generally of high quality and technically rigorous. (The USQ program at the Radioactive Liquid Waste Treatment Facility was also found to be of high quality and comprehensiveness. See Facility Maintenance and Operations, Core Function 2, in Appendix E.) However, a few procedural deficiencies were identified:

- **USQ Personnel Qualification Documentation.** The LANL USQ screening and determination procedure requires that personnel preparing, reviewing, and approving USQ documents must have a bachelor of science degree in engineering or physical sciences or an equivalent approved by facility management, among other qualifications. However, there are no requirements for documenting educational equivalency.

- **Enveloping Unreviewed Safety Question Determinations (USQDs).** The LANL USQ screening and determination procedure and the corresponding CMR-specific procedure both allow a change to be screened out of the process if it is "completely enveloped by a previous USQD." However, neither procedure requires an explanation of how and why the previous USQD is enveloping, or even that the specific USQD be identified. This does not provide adequate and auditable documentation of the screening determination rationale.

- **Communication of Changes in USQD Procedure.** One facet of the USQ program had recently changed, but the changes had not been adequately communicated to and understood by the program users. The current USQ procedure requires that controls and compensatory measures be reviewed in the USQ process when temporary or interim equipment configurations are implemented that are not covered by the existing authorization/safety basis, such as exist during maintenance or construction activities. The previous revision had explicitly directed users *not* to address temporary configurations. Two instances were identified in which users did not understand the revised requirements and believed that temporary configurations were not to be addressed.

- **HEPA Filter Changeout USQ.** Although the technical quality of the USQDs was commendable, one technical concern was identified with the USQD for changeout of HEPA filters in Wings 2, 5, and 7. This evolution involved securing the exhaust fan in the division being changed out and using the opposite division's fan to maintain the proper air flow direction during the change out to prevent release of contamination. However, it did not consider the potential for the loss of the one operating fan during this evolution, which would have left the system in a condition outside the authorization basis, with the potential for contamination release to the environment.

Design Change Process. The OA team reviewed seven design changes and identified a number of programmatic deficiencies. However, all of the design changes were performed according to the previous version of the facility design change procedure (no recent design changes were available for review). The new LANL procedure for design changes (issued February 2002) is a major step forward in providing needed controls on design changes. The new procedure addresses many of the causes of the programmatic deficiencies identified in the seven reviewed design changes. However, the recently issued procedure has a number of weaknesses:

- The design change procedure contains inadequate provisions to ensure integration of inputs from all potentially affected parties at key process junctures, such as the beginning of conceptual design, the midpoint, the completion of design, and the completion of construction, installation, startup, and testing.
- The review/signoff requirements in the design change procedure do not include major organizational contributors to the process, such as maintenance, operations, construction, procurement, environmental, testing, and radiation control.
- The design change procedure does not include requirements early in the process for identification of specific documents likely to require revision or generation, and documented completion of such revisions at the end of the process.
- The design change procedure did not require inclusion in the change documentation of all review-and-comment documents (discussed further later in this section).

Review and Comment Process. A formal review and comment process does not currently exist. Such a process provides the vehicle for formal, documented review and comment by knowledgeable personnel in the organization on virtually any safety-related subject or document, and the requirement for formal, documented responses by the responsible parties to the comments. Such a process is vital to effective feedback and improvement.

Equipment Identification and Tagging. Equipment identification and tagging is a fundamental element of effective configuration management and essential to other elements of integrated safety management, such as good quality operating procedures. With the exception of TSR equipment and equipment related to personnel safety, many components in the facility are not identified by name and number. Progress in this area has been slow. Attempts to go beyond the most basic features, such as requiring bar coding, appear to have added substantially to the resource requirements and impeded progress.

Drawing Control. A fire suppression system walkdown revealed that pressure pumps and associated piping are connected to the fire protection suppression system, and these components are not depicted on the engineering drawings of record. These components were added sometime after the original system was installed and prior to the 1998 approval of the BIO that declared the fire protection system a safety-class system. A modification package for the installation of the pumps and supporting USQD documentation could not be retrieved. The purpose of the pressure pumps is to pressurize the sprinkler system above water main supply pressure.. The higher pressure on the sprinkler side of the fire suppression system check valve prevents the check valve disk from lifting and causing nuisance alarms when water pressure surges occur in the water main system. (A similar problem was identified at the Radioactive Liquid Waste Treatment Facility in that appropriate documents, drawings, and procedures are not consistently updated following a facility modification. See Appendix E, Core Function 3.)

Root Cause and Corrective Action Program. Two facets of a root cause and corrective action program exist in the CMR facility. One is a formal process that is part of the occurrence reporting process. The other is an informal process that addresses many of the discrepancies, process and equipment failures, and non-conformances that do not rise to the level for reporting to the Occurrence Reporting and Processing System (ORPS).

- **Formal Root Cause and Corrective Action Process.** One occurrence reporting process example was identified, concerning the Wing 7 HEPA filter radiological overload, where the required root cause and corrective action steps were considered by the OA team to have been inadequate to fulfill the intent of the process, as follows. In January 2001, operations were shut down in Wing 7 when it was discovered that the wing HEPA filters had radiological loading substantially in excess of the BIO accident analysis assumptions. Following changeout of the filters in early February 2001, operations were resumed without determining the cause of the excessive loading. This determination was not made until July 2001, when direct arc spectroscopy operations in one of the laboratory rooms was informally identified. At that time, the local HEPA filter for the glovebox in which these operations were being performed was replaced. On January 31, 2002, a memo was sent from CMR to the Office of Los Alamos Site Operations containing an informal calculation supporting a proposal that the direct arc spectroscopy process should be limited to 36 additional repetitions to prevent exceeding the wing HEPA filter loading limits again. DOE approval corrective action measure has not yet been granted.

  The OA team observed that if the direct arc spectroscopy process had actually been the primary source of the excessive HEPA filter loading, then the glovebox HEPA filter changed out in June 2001 would have had to have been either extremely heavily loaded with plutonium or failed, neither of which was actually the case. Therefore, the originally postulated probable source of the wing HEPA filter excessive loading was considered by the OA team to have been in error. Subsequent to the January 31, 2002, CMR memo, another more likely source was discovered by CMR staff in a sample preparation step for the direct arc spectroscopy process that was being performed in a different glovebox not protected with a local HEPA filter.

  The OA team also observed that the responsibility for establishing, tracking, documenting, and enforcing the limit of 36 repetitions had not been formally promulgated, and that the calculation that determined this limit had not been prepared, reviewed, and approved per the Design Control Manual requirements.

The process weaknesses associated with this example include:

- Operations were resumed without formal identification of the condition's cause.
- Initial probable cause identification of the condition was not timely.
- Initial probable cause identification was not correct.
- Final probable cause identification was even less timely.
- The calculation to limit the repetitions of the direct arc spectroscopy process was not performed per the applicable procedure.
- Directions for limiting the number of repetitions of the process and delineating the responsibility for tracking and documenting the process repetitions were not formally promulgated.

- **Informal Root Cause and Corrective Action Process.** An informal facility process for performing root cause identification and corrective actions for those discrepant items that do not rise to the level of ORPS occurrences is the lessons-learned process. This is an informal process that in a short period has evolved and continues to evolve many of the positive attributes of an effective program. However, it currently is mainly applied to radiological incident reports or other discrepancies specifically identified by facility management. To be optimally effective, the process should be formalized by procedure and expanded to uniformly address most important-to-safety discrepancies to be identified by anyone cognizant of such discrepancies In addition, the number of individuals responsible for the various contributing functions should be expanded and formally promulgated to include persons with the appropriate technical expertise and persons formally trained in root cause identification techniques. The OA team identified the following two examples where this process should be currently applied to address significant important-to-safety concerns:

  - **Fire Suppression System Water Hammer**. The CMR fire protection system engineer identified to the OA team that the safety-class fire suppression system is occasionally challenged by pressure surges (water hammer) apparently initiated from the TA-3 grid. Further evidence of the existence of water hammer events at CMR is supported by the fact that the sprinkler system is pressurized above each wing's riser alarm check valve to a pressure above the TA-3 grid water pressure to prevent spurious alarms due to pressure surges from the grid. Finally, a failure of a CMR ten-inch ring header gate valve in 1997 most likely occurred over time by system water hammer events. No formal action has been taken by Facility and Waste Operations (FWO) Fire or FWO Utilities to address the water hammer concern, such as determining what operations could be causing water hammer and implementing new procedures or revising existing procedures to prevent recurrences. CMR has not used the USQD process to evaluate whether these water hammer events are within the design basis for the safety-class fire suppression system as defined in the BIO.

Finding: LANL has not identified as a concern or formally mitigated the effects of water hammer events in the TA-3 water system that repeatedly challenge and reduce the reliability of the CMR safety-class fire suppression system.

  - **Fire Assessment/Fire Hazards Analysis Deviations.** No action plans have been developed in response to the emergency management and fire protection assessment (August 2001). This assessment determined that the fire alarm and suppression systems may not adequately support mitigation of fire emergencies. There is no action plan developed by FWO to address the assessment report, although FWO committed to provide an action plan. Additionally, numerous deficiencies identified in the 1998 LANL fire hazards analysis report are not formally tracked and prioritized. Thirty-seven deficiencies have been identified with a ranking, consequence, and recommendation noted. These deficiencies are not formally tracked. (See the discussion in the LANL issues management system in Appendix D.)

Finding: LANL has not adequately and promptly addressed significant previously recognized discrepancies with fire protection, including those documented in the emergency management and fire protection assessment (August 2001) and in the 1998 CMR fire hazards analysis report.

Calculations/Analysis for the Fire Suppression System. The sprinkler hydraulic calculations were reviewed. These calculations were prepared to establish the acceptance criteria for the TSR water main pressure requirements. The calculation uses a water spray density number that is based on the data found on the hydraulic data card nameplate on each wing's system pipe riser. The calculations and other supporting documentation that support the hydraulic data cards spray density do not exist. The BIO and fire hazards analysis categorize CMR as a combustible loading Ordinary Group 2 facility that would, by current National Fire Protection Association (NFPA) 13 code requirement, require a higher spray density than is used in the calculations. LANL is aware of this issue and has suggested that the spray density conforms to the older code, in effect recognizing that supporting documentation is unavailable. Recently, LANL has significantly reduced the combustible loading in CMR to a point that reclassification to a lower combustible hazard facility may be feasible. The OA team has reviewed the significance of the lower spray density input and determined the difference in the spray density input versus the current code requirement would not have a significant impact on the capability of the current system to deliver the required flow.

Standpipes are located in each wing and are independently routed from the underground fire main. These standpipes are used by responding firemen as a source of water for their inside fire hoses. The standpipes are undersized based on current NFPA 14 requirements, and an analysis performed by the OA team indicates that the available flow from the CMR standpipe system is not adequate to meet the Los Alamos Fire Department needs. The system engineer confirmed that testing performed to NFPA 25 requirements resulted in substandard standpipe flow test results. This testing was performed approximately one year ago, and to date no corrective action has been initiated to address the deficient flow issue. It was determined during the initial interview with the Los Alamos Deputy Fire Chief that he was unaware of the magnitude of the fire standpipe limitations. This new information will help the fire department more efficiently fight a fire at CMR, especially knowing that a fire pumper truck needs to be hooked up to the system in order to use the hoses connected to a standpipe.

Finding: The standpipes at CMR, as installed, are undersized and will not pass the NFPA code flow requirements and Los Alamos Fire Department expectations; the Los Alamos Fire Department was unaware of the standpipe limitation.

In summary, required configuration management programs have been evolving at a very rapid rate, and commendable progress in this area was evident. However, several fundamental programmatic elements of an effective configuration management were missing or inadequate. With a few exceptions, the authorization basis documents are clear, concise, accurate, and complete, but were deficient with regard to wildland fire accident analysis, HEPA filter differential pressure tracking, and controls for uranium hexafluoride operations. The quality of completed USQ determinations was satisfactory; however, improvement was needed in documenting personnel qualifications and referencing enveloping USQ determinations. A formal review and comment process does not exist and needs to be developed. The equipment identification and tagging program is proceeding, but currently many important systems have not been completed. Improvement is needed in the root cause and corrective action programs at CMR, as shown by the inadequacies in the review of the Wing 7 HEPA filter overloading and fire suppression system valve failure occurrences. Further review of the valve failure revealed that the continuing effects of water hammer events within the TA-3 water system on the CMR fire suppression system, a safety system, have not been adequately addressed. Finally, critical calculations used to support authorization basis decisions are not properly reviewed and approved as required by the calculation control program.

Finding: Current configuration management systems and practices do not contain some essential elements, including a fully effective design change process, completion of equipment identification and tagging on several important systems, a formal review and comment process, and a fully mature root cause and corrective action program.

F.2.2 System Maintenance

Maintenance conducted on the heating, ventilation, and air conditioning (HVAC) system in CMR satisfies system requirements and performance criteria in safety basis documents and other LANL maintenance requirements. Review of maintenance history files for selected HVAC components indicates that preventive and corrective maintenance is being conducted in accordance with prescribed work packages and work instructions. Implementation of scheduled preventive maintenance is tracked and monitored to ensure that structures, systems, and components receive required preventive maintenance. This metric is included in Johnson Controls of Northern New Mexico (JCNNM) contract requirements for award fee determination. A baseline goal of 97 percent for all facility management units (FMUs) for completion of preventive maintenance was established, with a stretch goal of greater than 99 percent. Review of trend data for CMR (FMU 65) indicates that for the last four months (October 2001 to February 2002), 100 percent of the scheduled preventive maintenance was performed and completed as scheduled.

CMR has been capable of maintaining a relatively high (typically 95 percent) building availability rate to support mission requirements. CMR monitors building availability as a key indicator for determination of the effectiveness of the maintenance program, which is also part of the LANL University of California contract performance measures in Appendix O. CMR is using preventive maintenance and predictive analysis (i.e., vibration analysis) effectively to address facility-related causes of building and wing unavailability, such as HVAC fan maintenance and fan failures. In addition, modifications and equipment upgrades to address aging-related system degradation that could affect system reliability or performance are also being implemented as necessary. For example, a number of HVAC system upgrades, such as installation of HVAC differential pressure indicators, modifications to the stack monitoring systems to come into compliant with 40 CFR 61, HVAC filter replacement assessment and procurement, and installation of a new facility monitoring system to monitor critical facility system data in the Operations Center, were in various stages of completion.

LANL has established a Laboratory Implementing Requirement (LIR) and Laboratory Implementing Guides that establish adequate requirements for identifying the structures, systems, and components for inclusion in the LANL maintenance management program. CMR has established a master equipment list (MEL) in accordance with the LIR and implementation guidance. Key active and significant components, such as HVAC supply and exhaust fans and motors, HVAC roughing and HEPA filters, stacks, and fume hoods, are included in the MEL. The current version of the MEL is generally current (less than one year old); however, quarterly updates to the MEL were discontinued due to staffing reassignments. In addition, vendor manuals (where available), industry standards, DOE orders, and prior operating experience are used for development of system maintenance work packages. The technical basis for the current preventive maintenance program for key components is based on prior operating experience, typical industry practices, and use of limited predictive (i.e., vibration analyses) techniques. Although vendor manual technical information is lacking in many cases, as new equipment is installed, such as replacement motors for the HVAC exhaust fans, technical information is being retained for establishing a technical basis for maintaining new equipment.

CMR management is appropriately placing high priority on improving management of the corrective maintenance backlog. CMR management recently (November 2001) initiated a review of all job requests in the maintenance backlog, resulting in the establishment of a facility-level prioritized maintenance work backlog. A weekly management review of the entire maintenance backlog is conducted to identify priority work orders. Over 50 percent of the backlog has been prioritized (about 100 jobs) for work. About 150 other jobs are still in the backlog of unprioritized work. The OA team's selective review indicates that the work requests were correctly prioritized. In addition, CMR management is in the process of adding maintenance management staff to improve the scheduling and planning functions for facility maintenance.

While management actions to more effectively manage the backlog of maintenance are generally appropriate, management tools to effectively monitor progress in addressing maintenance backlog, such as backlog metrics/trending on work order age and input and output (i.e., backlog increasing or decreasing), were not currently used by management. CMR facility and maintenance managers recognize a need to further strengthen management tools for monitoring and trending the effectiveness of managing the backlog of maintenance.

Documentation of maintenance activities, equipment problems, and inspection and test results is not sufficient to meet all of the requirements of the applicable Laboratory Performance Requirement (LPR). For example, a review of a sample of 30 completed work packages for corrective maintenance on the HVAC system indicates that insufficient information from the crafts and/or system engineer is being captured in maintenance history files to facilitate effective equipment failure trending and analysis. Furthermore, review of CMR work control procedures indicates that for corrective maintenance, no individual is specifically assigned the responsibility for ensuring the documentation of as-found conditions and cause of equipment failures for corrective maintenance on ML-1 and ML-2 systems in corrective maintenance work packages. Lack of formal documentation of as-found equipment conditions and failure analysis limits LANL's ability to satisfy LPR requirements. Discussions with CMR facility and maintenance managers indicated that performance and documentation of equipment failures and trending analysis is an area needing improvement. Management also indicated that the current tools used maintenance work control, such as the maintenance database, were not sufficiently developed to fully support the end users and are not being utilized.

Systems engineers adequately understand the operational features, safety requirements, and performance criteria for the HVAC system. System engineers are actively involved in identification and review of post-maintenance testing and procurement requirements for like-for-like component equipment replacements for equipment, as required by CMR work control procedure. Evidence of formal equipment trending and failure analysis, other than vibration analysis, however, was limited. The lack of formal trending of equipment performance was identified as an area of need of improvement by LANL Audits and Assessments in the September 2001 facility management assessment audit and an external assessment of maintenance management program. However, discussions with systems engineers indicated they were knowledgeable of recent equipment performance problems and have been interfacing with facility operators and craft personnel to maintain awareness of potential emerging equipment issues.

While post-maintenance testing requirements were sufficiently identified for the ML-1 and ML-2 work packages that were reviewed, in most cases work packages and work instructions did not specify any requirements for use and documentation of calibration requirements of measuring and test equipment (M&TE). Discussions with CMR staff indicate that actions are in progress to address the issue of traceability of M&TE in the conduct of maintenance, and a draft administrative procedure on calibration and control of measuring and test equipment was provided to the team. The draft procedure adequately addresses this area and, if effectively integrated into the CMR work control progress, provides an adequate method for identifying, controlling, calibrating, and documenting M&TE used in CMR operations.

Several examples of poor housekeeping and quality control for maintenance work were noted in the ventilation system walkdown (e.g., equipment holddown nuts were missing) and in the filter tower areas. CMR management recognizes the need to improve overall housekeeping, as evidenced by a recent safety briefing that highlighted poor housekeeping in JCNNM work areas in the attic of CMR. Facility management intends to set up specific work areas to be controlled by JCNNM for their work areas. CMR management also took immediate corrective actions to walk down HVAC areas in the CMR building to identify and correct equipment bolt deficiencies.

In summary, the overall material condition of the HVAC system is being adequately maintained to ensure that the condition of the system will support building safety and mission requirements. The system is inspected periodically according to maintenance requirements, and deficient conditions are evaluated and corrected. Weaknesses observed by the team in the implementation of the maintenance program have been identified in previous assessments and are being actively addressed by CMR management. However, continued attention is needed to more effectively manage the backlog of maintenance, and further strengthen the effectiveness and integration of system engineering functions in the work control process.

F.2.3 Surveillance and Testing

TSR Test Results. With a few exceptions, TSR test results were generally adequate. However, deficiencies were identified with the HVAC flow balance test and with the ventilated hood performance test. The Wing 3 HVAC flow balance test was inadequately evaluated and documented. The documentation for a 1998 HVAC system flow balance appeared to leave the flows for two of the lab rooms in Wing 3 in the wrong direction (from the more contaminated rooms to the less contaminated corridor). An informal test conducted by maintenance and witnessed by OA during the assessment verified that ventilation flow in Wing 3 was in the correct direction. Documentation was completed to show these results. The ventilated hood performance tests do not adequately track and document the status of ventilated hoods when changes occur between the semiannual performance tests. One hood was changed from an open port hood to a glovebox in October 2001 by installing gloves on the open ports. This change also affected the adjacent ventilated hood, requiring it to be placed out of service. These changes were not formally documented in the Operations Center logbook or added to the current semiannual ventilated hood performance test.

TSR Procedures. A controlled set of TSR procedures is maintained in the Operations Center and is used to ensure that the latest TSR surveillance procedure is selected for field performance. With a few exceptions noted below, the TSR procedures were written in accordance with the guidelines provided in the TSR Instruction Writer's Guide and were being carefully used by the operations staff. One deficiency was discovered with the TSR daily round sheet data sheets. Several readings on the data sheet were marked as "not applicable," without further explanation in the comments section. This information should be recorded to clearly document off-normal conditions in the facility with regard to TSR compliance. Next, the TSR performance test for ventilated hoods procedure provides unclear instructions on how to record the ventilation flow data. Furthermore, with regard to this test procedure, it is unclear whether instrument inaccuracies are taken into account when verifying the TSR set points or that criteria are being met.

TSR Instruction Writer's Guide. The TSR Instruction Writer's Guide does not provide clear guidance on the requirements for validation and verification of a new or significantly changed TSR procedure. Documentation supporting the completion of validation and verification was not available for the current set of approved TSR procedures. For example, completed Instructional Criteria checklists that should be completed during validation and verification were not available for the fire main drain and sprinkler flow test procedure. In addition, the writer's guide does not define the requirements for TSR procedure development historical files. Document control personnel are in the process of creating historical files for the TSR procedures. Some information important to procedure development was available for some of the TSR procedures, but a systematic approach had not been taken to ensure that technical background information supporting key assumptions in the procedures was included in the historical files.

TSR Procedure Implementation. Prior to the start of a TSR procedure, the qualification of the assigned operator is verified using a special training and qualification list. This ensures that the assigned operator is familiar with the latest changes in the procedure prior to performing the task. To further ensure that the participants are ready to perform the main drain and sprinkler flow test, a pre-job briefing and walkthrough are conducted each time the test is performed. This is because several crafts outside of CMR are involved in the performance of this test. Therefore, CMR is taking adequate steps to ensure that only qualified operators or craft perform TSR procedures.

It is noted that CMR management has taken steps to ensure that TSR surveillances are performed on time. The latest completion and due dates for the TSR surveillances are closely tracked on a bulletin board in the Operations Center. In addition, TSR surveillance status is recorded in the Operations Center logbooks, documented on turnover sheets, and discussed during operations daily briefings.

TSR Implementation Review. The LANL Office of Authorization Basis recently completed a thorough review focused on TSR implementation at CMR (TSR Assessment Report FWO-OAB-1002). The TSR review found some similar issues to this OA inspection. Several weak TSR areas have been corrected since the review. This has contributed to improvements in TSR procedure writing and the tracking and delivery of TSR procedure training.

In summary, surveillance and testing activities in the CMR facility generally provide adequate assurance that TSR requirements are being met. Surveillance and test procedures are organized in a logical and concise manner. The procedures contain the appropriate attributes, such as signoffs, dates, references to limiting conditions of operation sections, limits, precautions, prerequisite conditions, data required, and acceptance criteria. Instrumentation and M&TE for the system are calibrated and maintained.

F.2.4 Operations

The most significant vulnerability in operations is the lack of a set of operations procedures for the major systems in the facility. This deficiency was identified as part of a gap analysis for implementation of DOE Order 5480.19, *Conduct of Operations*, at CMR that was completed in November 2001. To address this concern, the facility is in the process of developing the needed operations procedures, including procedures for the steam system, HVAC, facility monitoring, fire protection, uninterruptible power, emergency power, emergency notification, emergency personnel accountability, and compressed air. This major undertaking is in the initial stages. Progress is being closely tracked, and the first finalized procedure is scheduled for completion in May 2002. To date, there appears to be adequate coordination between the engineering and operations groups during the developmental steps for the new procedures. (The weakness in conduct of operations, especially with procedures, is a LANL-wide problem; similar procedure weaknesses were found at the Radioactive Liquid Waste Treatment Facility, as discussed in Appendix E. The finding under Core Function 3 of Appendix E encompasses the lack of procedures for CMR safety-related systems identified in this section.)

CMR management has been working to improve conduct of operations. In November 2001, an assessment was conducted to evaluate the implementation of conduct of operations at CMR. The deficiencies from this review were evaluated, and corrective actions were either completed or are in process. In addition to pursuing improvements in operating procedures and training, several other conduct of operations deficiencies were addressed. For example, an Operations Center shift briefing was started to ensure that operators understand the facility status and plan-of-the-day activities prior to starting the shift. Also, procedures were revised to ensure that the operations supervisor approves the start of work.

Current operations are being conducted by qualified and knowledgeable operators using existing procedures and documentation where available. The current set of procedures consists of a small number of operations defined in standing orders, such as restart of CMR ventilation systems. TSR surveillance procedures and emergency procedures are documented in response instructions. Other operations are not controlled by procedures and rely on operator knowledge, skill, and experience. Operations of ventilation and fire suppression that were observed were conducted within the BIO and the TSRs.

The Facility Operations Center operators, facility operations technicians, and other key positions have completed a formal qualification process. The current qualification program is adequately defined in a CMR administrative procedure. CMR staff individual qualification cards were properly completed and retained in accordance with the qualification program procedure. The content of the qualification program covered the areas necessary to ensure that operators have the requisite knowledge and skills. The current qualification process is being completely revised and will be based on position job task analyses.

During the review, several operators demonstrated during walkthroughs and interviews that they were knowledgeable in the operation of the ventilation and fire suppression systems. They followed the appropriate TSRs when presented with abnormal conditions, responding to a simulated fire in a glovebox and a simulated loss of Wing 9 ventilation. One exception was noted during a field demonstration in which a ventilation subject matter expert was manually starting the ventilation fans in Wing 9 and incorrectly performed the simulated sequence of fan starts. The subject matter expert realized his error during the demonstration and corrected the error. The individual was relying on his knowledge of the system rather than using the available procedure.

System design descriptions (SDDs) provide detailed information on the many facility systems and are used as a source of information for training for facility operations. In general, the SDDs are accurate and useful. However, some SDDs have not been updated to the latest configurations. For example, the ventilation SDD does not reflect the latest information about programmable logic computer control of the ventilation fans in the different wings. One of the responsibilities of System Engineering is to periodically update the SDDs when required.

The two Facility Representatives assigned to CMR are providing daily oversight of a number of activities being conducted in the facility, which were selected based on their potential hazard. In addition, random walkarounds are conducted in the different wings. Deficiencies are communicated to CMR management via meetings and email. The Facility Representatives have identified TSR deficiencies in the ventilation and fire suppression systems. For example, the CMR Facility Representative identified the problem of removed ceiling tiles around sprinkler heads that would cause a delay in sprinkler head activation during a fire (see Appendix D).

In summary, CMR currently does not have a set of system operating procedures. The lack of a complete set of operating procedures is a significant vulnerability to safe operations at CMR. The facility is in the process of developing the needed procedures over the next several months. The operations staff is fully knowledgeable of plant systems, the authorization basis, and the TSRs. The operations of fire suppression and ventilation systems are being conducted in accordance with TSR limits.

F.3 CONCLUSIONS

Several fundamental programmatic elements of an effective configuration management were missing or inadequate. The authorization basis documents were deficient with regard to wildland fire accident analysis, HEPA filter differential pressure tracking, and controls for uranium hexafluoride operations. The quality of completed USQDs was satisfactory; however, improvement was needed with documenting personnel qualifications and referencing enveloping USQDs. A formal review and comment process does not exist and should be developed. The equipment identification and tagging program is proceeding, but many important systems have not been completed. Improvement is needed in the root cause and corrective action programs at CMR, as shown by the inadequacies in the review of the Wing 7 HEPA filter overloading and fire suppression system valve failure occurrences. Further review of the valve failure revealed that the continuing effects of water hammer events within the TA-3 water system on the CMR fire suppression system, a safety system, have not been adequately addressed. Critical calculations used to support authorization basis decisions are not properly reviewed and approved as required by the calculation control program. Further, CMR currently does not have an adequate set of system operating procedures.

Many aspects of the fire suppression and ventilation systems at CMR are effectively implemented. The overall material condition of the HVAC system is being adequately maintained to ensure that the condition of the system will support building safety and mission requirements. Surveillance and testing activities in the CMR facility generally provide adequate assurance that TSR requirements are being met. The operations staff is fully knowledgeable of plant systems, the authorization basis, and the TSRs, and operations of fire suppression and ventilation systems are being conducted in accordance with TSR limits.

The Office of Los Alamos Site Operations and LANL CMR management are knowledgeable of the current weaknesses and have ongoing efforts to address several of them, including plans to develop procedures and address maintenance program shortcomings. Additional attention is needed to fully address deficiencies in a few areas, such as configuration management, the new system design procedure, root cause and corrective action, wildfire analysis, and water hammers.

F.4 RATINGS

Configuration Management .... NEEDS IMPROVEMENT
Maintenance .... EFFECTIVE PERFORMANCE
Surveillance and Testing .... EFFECTIVE PERFORMANCE
Operations .... NEEDS IMPROVEMENT

F.5 OPPORTUNITIES FOR IMPROVEMENT

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

1. **Enhance the authorization basis to include analyzing conditions and events not previously analyzed.**
   - Perform USQD evaluations for undocumented modifications to fire suppressions systems and water hammer events.
   - Evaluate wildland fires as external initiating events, including the impact on water supplies at CMR. Extend the evaluation to other LANL facilities as appropriate.
   - Modify the TSR basis to improve statements regarding interpretation of HEPA filter differential pressure data and require plotting of data to detect trend anomalies.
   - Add a complete discussion of the hazards of uranium hexafluoride to the facility hazards analysis, including the associated hazards to workers in the facility.

2. **Enhance configuration management programs to include root cause analysis and corrective actions, a formal review and comment process, and comprehensive equipment identification and tagging.**
   - Institute an appropriate root cause and corrective action program to address failures of equipment or processes important to safety.
   - Institute a formal, documented review and comment process that provides an opportunity for review of a wide range of safety documents and formal resolution of comments.
   - Perform formal root cause analyses and comprehensive corrective actions on previous significant equipment failures, including the radiological overloading of Wing 7 HEPA filters beyond their accident analysis assumption and failure of the fire protection system main ring header valve.
   - Perform root cause analysis of deficiencies identified in the fire assessment/fire hazards analysis deviations.
   - Review the current equipment labeling process and system priorities. Continue to actively identify and tag major plant equipment in order to enable the generation of effective plant procedures and other activities important to safety.

3. **Provide maintenance and operations personnel with needed tools.**
   - Ensure that procedures are completed on schedule and expectations for their use are clearly communicated.
   - Develop and/or enhance tools for maintenance management including useful databases.
   - Ensure that MELs are kept current.

4. **Improve the controls of USQ process.**
   - Change USQ procedures to require documentation of educational equivalence.
   - For changes screened out of the USQ process because they are already addressed by an enveloping USQD, change USQ procedures to require that the enveloping USQD be identified and that the rationale for considering the USQD as enveloping be stated in sufficient detail to allow a reviewer to reach the same conclusion.
   - Provide training updates to inform USQ process users that temporary configurations that may exist during the time a change is being effected are required to be considered in the process, including temporary configurations during maintenance activities.

5. **Improve the design change procedure.**
   - Add requirements that all "interested parties" to the change be formally given the opportunity to provide input to the change at key junctures in the design change process
   - Add a requirement that all formal documented reviews and comments from "interested parties" be included in the design change documentation, along with the formal responses to such comments. Ensure that all major organizational "interested parties" are included in procedure signoff lists.

- Add requirements that specific documents likely to require revision or generation are identified early in the design change process and that the execution of such changes is verified at completion.

Appendix G

Environmental Protection

G.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluated the implementation of the core functions of integrated safety management (ISM) as they relate to environmental protection activities at Los Alamos National Laboratory (LANL). The purpose of the review was to evaluate the adequacy of LANL management processes in analyzing and controlling potential environmental impacts relating to site operations and legacy hazards. In conducting this evaluation, the OA team reviewed the adequacy and implementation of site policies and procedures, performed walkdowns at the Chemistry and Metallurgy Research (CMR) facility and the Radioactive Liquid Waste Treatment Facility (RLWTF), evaluated the operation of pollution control equipment, interviewed LANL and Office of Los Alamos Site Operations (OLASO) personnel, and held technical discussions with environmental protection subject matter experts and operating department personnel. Technical evaluations of site programs were performed in the areas of waste management, groundwater protection, radiological air emission controls, and liquid process effluent controls.

G.2 RESULTS

G.2.1 Core Function 1 - Define Work

For most areas evaluated, the scope of the site's environmental protection responsibilities have been appropriately defined. OLASO and LANL have effectively evaluated laboratory mission activities, identified applicable environmental protection requirements, and incorporated the applicable environmental requirements into the LANL work smart standards set. Applicable regulatory requirements were appropriately identified and included in the work smart standards for all areas evaluated during this assessment. LANL work smart standards also appropriately incorporate DOE environmental protection requirements and orders. In several areas, OLASO and LANL determined that certain portions of the DOE orders were not necessary to incorporate into the standards set; in all cases, these omissions are reasonable and adequately justified.

OLASO and LANL have applied for and/or obtained applicable or environmental permits required for performance of mission work, including Resource Conservation and Recovery Act (RCRA), National Pollutant Discharge Elimination System (NPDES), and groundwater discharge permits. These permits define the scope of authorized hazardous waste management activities, effluent discharge limits, monitoring requirements, and reporting requirements applicable to LANL.

LANL has established management processes to implement its environmental protection responsibilities. The LANL ISM system description incorporates environmental protection considerations. Environmental compliance criteria are incorporated into site work planning and control procedures. Laboratory Performance Requirements (LPRs) and Laboratory Implementation Requirements (LIRs) have been developed to communicate most applicable environmental requirements to operating organizations. Within LANL divisions, including the Environment, Safety and Health division (ESH), groups have been assigned to implement components of the site environmental protection program. In the areas evaluated, LANL has the appropriate level of staff expertise to implement the program requirements.

OLASO and LANL have appropriately incorporated environmental performance measures in Appendix F of the contract between DOE and the University of California for LANL. Several measures provide incentives to achieve environmental protection objectives, including reduction of inventories of existing wastes, implementation of the Radioactive Liquid Waste upgrades, and compliance with environmental requirements.

While most of the fundamental elements of an effective environmental management system have been established through the LANL ISM system, some important gaps exist:

- The current LANL safety and security policy is focused on compliance with environmental requirements and zero tolerance for environmental incidents. Environmental stewardship policies are not clearly established in some areas, including pollution prevention/waste minimization and protection of groundwater resources.

- Current LPRs and LIRs do not address, in a systematic manner, institutional environmental management processes. For example, formalized processes have not been established at the institutional level to identify the significant environmental aspects of LANL operations, develop environmental policies, and establish consensus priorities and goals. Additionally, LANL groups with institutional environmental protection responsibilities have not systematically applied LIR quality management criteria to management plans and procedures.

- The LPR that establishes performance criteria and lists standards for environmental protection (i.e., LPR 404-000-00.0) and associated implementing LIRs are incomplete and outdated in some areas. DOE environmental protection orders are not fully reflected in the LPR or LIRs. The LPR does not address DOE Order 5400.1 requirements for waste minimization or water quality. DOE Order 5400.5 is only listed as applicable on the air pathway although many of the order requirements for liquid discharges are applicable. The LPR references DOE Order 5820.2A rather than its replacement (DOE Order 435.1), which is specified in the work smart standards and contract.

LANL management has recognized the need to strengthen the environmental protection function within its ISM system. An April 2002 reorganization was undertaken to consolidate environmental functions within the new Risk Reduction and Environmental Stewardship Division. An "E is ISM" committee has performed a gap analysis between current management systems and the elements of International Standards Organization (ISO) 14001. LANL personnel have developed a draft integrated management plan for environmental protection that establishes a framework for institutional environmental protection programs. ISO 14001 elements and LIR quality criteria are being incorporated in the management plan.

The scope of ongoing LANL groundwater protection planning efforts has not been defined consistent with DOE expectations. Specifically, LANL does not have an updated Groundwater Protection Management Program Plan (GWPMP) that meets DOE Order 5400.1 requirements for describing hydrogeology, documenting the monitoring strategy, and establishing groundwater pollution prevention strategies. A key goal of the GWPMP is to integrate groundwater protection information and strategies across the site. LANL discontinued updating their GWPMP in 1996. The 1998 LANL Hydrogeologic Workplan guides subsurface characterization activities at LANL. The workplan is current, but focuses primarily on the characterization aspect of groundwater protection and does not address a risk-based approach for strategic programmatic planning for groundwater protection. Recently, LANL developed an Accelerated Groundwater Protection Action Plan to enhance groundwater protection activities. The Action Plan is currently in draft and undergoing management review.

Overall, OLASO and LANL have defined the scope of the site's environmental protection responsibilities and established appropriate programs and processes in most areas. In particular, appropriate requirements for environmental programs have been incorporated in the work smart standards, and most have been appropriately incorporated into laboratory directives. While fundamental elements of an effective environmental management system have been established through the LANL ISM system, a number of important gaps exist. LANL management has recognized the need to strengthen environmental functions within the ISM system, and actions to address identified gaps are ongoing.

G.2.2 Core Function 2 - Analyze Hazards

Operations of facilities at LANL involve the use of chemical and radioactive materials, and past operations have resulted in release of contaminants to the environment in the vicinity of the site. LANL has established mechanisms to evaluate the environmental hazard posed by ongoing operations and legacy materials.

Hazards to the environment posed by ongoing operations at CMR and RLWTF have been appropriately analyzed for most pathways and conditions. LANL has performed potential-to-emit and point-source-stack-classification calculations consistent with Environmental Protection Agency National Emission Standards for Hazardous Air Pollutants (NESHAPS). LANL has also established waste profiles that characterize the composition of solid and liquid wastes generated by research and development activities.

At CMR, changes in facility operations and research activities are reviewed for impacts on the environment. For example, the CMR facility activity approval process requires each new activity owner to fill out a waste generation questionnaire, which provides a means to analyze the proposed activities in order to determine what controls will be necessary.

Following the Cerro Grande wildfire in May 2000, LANL conducted a vulnerability study for RLW facilities and operations, including RLWTF. Potential failures of systems and controls that could lead to operational stoppages, environmental releases, and impacts on laboratory activities were analyzed. This study identified important system vulnerabilities and included recommendations to upgrade the capacity and technical design standards of the influent storage tanks, replace most underground single walled piping systems at RLWTF, and redirect some non-radiological sources. Some upgrades are planned in the next year.

LANL is also performing activities to characterize legacy contamination and evaluate public and environmental hazards, including efforts to evaluate site hydrogeologic systems and the nature and extent of groundwater contamination. The current ongoing groundwater programs and activities involving characterization and monitoring are contributing significantly to the long-term needs of LANL. Wells installed as part of the Hydrogeologic Workplan are providing valuable characterization data and analyses across LANL facilities. Also, the environmental restoration program is generating the necessary data and analysis, including risk assessments, for the heavily contaminated areas at LANL. The geochemical understanding of the subsurface at LANL is progressing rapidly. Collectively, these data collection efforts and analyses are providing information to support environmental stewardship responsibilities and sitewide remedial decision-making.

The subsurface disposal horizon of the Area G low-level waste disposal facility has appropriate monitoring systems in place to detect the potential releases of contaminants to strata around and directly below disposal trenches. For example, LANL conducts soil gas monitoring for volatile organics and soil moisture sampling in wells for several hazardous constituents (including tritium), and has installed horizontal vadose zone monitoring wells under some disposal vaults for the detection of potential leakage.

Much work remains to complete the hydrogeologic investigations at LANL. For example, LANL currently does not have a complete understanding of the fate and transport of contaminants in the groundwater resulting from discharges to Mortandad Canyon from the RLWTF radioactive liquid waste treatment plant. Based on a past water balance conducted in Mortandad Canyon, LANL studies assume that 70 percent of the effluent seeps directly through the canyon bottom just downstream of the outfall into the intermediate zone, while the other 30 percent flows toward the east along the canyon bottom and through the thick portions of the alluvium. The intermediate zone rocks are several hundreds of feet thick and directly overlie the regional aquifer. Discontinuous perched saturation zones containing significantly contaminated water have been measured in the intermediate zone rocks toward the east of the discharge location. LANL has not yet determined the direction or rate of movement of these contaminants in intermediate zones downward or toward the eastern property boundary. Future studies to evaluate these conditions are planned as part of the site environmental restoration program. Additionally, LANL plans to conduct investigations in Area G to delineate perched water in intermediate zone beds and additional characterization of the regional aquifer.

Progress in the execution of the Hydrogeologic Workplan has been impeded by the slower than expected pace of well installations. The lack of continuity in the well installation program has contributed to schedule slippages. Starting and halting installation activities has eliminated the opportunity to take advantage of efficiencies available with planned multiple installations.

Although most environmental hazards have been adequately analyzed, there are two areas where LANL has not fully evaluated the hazards of site operations: (1) insufficient analysis of potential contaminant release pathways from operational facilities, and (2) the absence of an evaluation of discharges to previously contaminated land areas against DOE Order 5400.5 soil column and as-low-as-reasonably-achievable (ALARA) requirements. These two areas are discussed below.

Although much is known about the integrity of waste piping systems and storage tanks onsite, LANL has not performed comprehensive vulnerability assessments for facilities and tank systems that would identify potential contaminant release pathways. LANL recognizes that several tanks and piping systems located at CMR and RLWTF are vulnerable to potential leaks because of aging and design weaknesses:

- The potential for leakage from four CMR Building 154 radioactive liquid storage tanks has not been reviewed. These tanks were used from the 1960s until the early 1980s for collection and pretreatment of radioactive liquid waste from Wing 9 of CMR and have long since been abandoned. These four tanks contain approximately 12,000 to 15,000 gallons of radioactively contaminated water. Since 1995, CMR has been developing a project to empty these tanks, and in 1997 the contents of the tanks were analyzed. However, no action has been taken to determine whether the two concrete tanks or the two tanks within the vault are leaking.

- RLWTF has several aging and single-wall tanks and piping systems that could leak radionuclides and chemicals into soils and perched groundwater. For example, RLWTF has a 75,000 gallon concrete tank of influent waste and single walled underground piping from plant construction in the early 1960s. In the early 1990s and in 1995, soil borings were made along the underground piping and under the tanks and process buildings. However, no soil borings have been performed since that time. In 1998, limited integrity testing was performed on the underground piping for the sludge lines, but not the influent or effluent lines. RLWTF management recognizes these vulnerabilities, and several projects are under development to replace the 75,000 gallon influent tank and part of the old underground piping. However, near term upgrades will not replace all single walled original 1960s piping systems underlying the facility.

In a related event, on February 26, 2002, LANL discovered that up to 48,000 gallons of diesel fuel was released into the ground from a storage tank in Technical Area (TA)-21. The leak is believed to have occurred between May 2000 and January 2002. The source of the release is a below-ground supply transmission line connecting the tank to the TA-21 Steam Plant. Subsequently, oil has been discovered in free phase approximately 150 feet below the ground surface.

DOE performance expectations in DOE Order 5400.1 require the capability for early detection monitoring where site operations have the potential to contaminate groundwater resources. For plateau locations such as CMR, RLWTF, and TA-21, LANL does not monitor perched groundwater or perform unsaturated zone monitoring near facilities with potential liquid release pathways.

Finding: Vulnerabilities associated with potential contaminant release pathways from operational facilities to the environment have not been fully analyzed.

Although some deficiencies are evident (see above and section G.2.1), LANL does implement significant groundwater protection initiatives, including compliance with NPDES and groundwater discharge standards, development of stormwater pollution prevention plans, and enhancements in RLWTF operations. Through these initiatives, risks to groundwater resources from surface water discharges and subsequent soil column infiltration are reduced. Additionally, the LANL environmental restoration program is addressing potential groundwater contamination sources from past operational impacts through identification and removal/isolation of contaminated source areas.

This evaluation also identified that radiological and non-radiological liquid discharges to previously contaminated land areas have not been formally evaluated against DOE Order 5400.5 soil column and ALARA requirements which are intended to prevent the continued spread and migration of previously deposited radionuclides in the environment. DOE Order 5400.5 defines a soil column as an in situ volume of soil down through which liquid wastes percolate from ponds, cribs, seepage basins, or trenches. The use of soil columns to retain, by sorption or ion exchange, suspended or dissolved radionuclides from liquid waste streams was prohibited when DOE Order 5400.5 was issued in 1990. Both Mortandad and Pueblo Canyons have in their history been utilized as in situ soil columns and thus have legacy contamination present. Since RLWTF successfully applied the best available technology (BAT) process to its liquid discharges in 1999, current RLWTF discharges do not violate the prohibition on soil column discharges. However in an effort to prevent the further spread of radionuclides previously deposited, DOE Order 5400.5 also placed a prohibition on discharges of any liquids, including uncontaminated liquids, to previously contaminated release areas. There is some subjectivity as to the interpretation of this prohibition on liquid waste streams first treated with BAT. However, the intent of the prohibition is to limit the continued migration and potential impacts of radionuclides from source areas. Other non-radiological and non-process sanitary discharges from various LANL and non-LANL liquid waste streams continue to Mortandad and Pueblo Canyons, both of which contain residual radioactivity as a result of past soil column impacts. The hazards posed by these ongoing discharges have not been fully evaluated in relation to the DOE Order 5400.5 soil column and ALARA requirements or integrated into sitewide liquid discharge goals, objectives, and long-term strategies.

Overall, OLASO and LANL have analyzed most environmental hazards. In particular, CMR and RLWTF operations have been appropriately analyzed for waste generation activities and radiological air emissions. LANL has identified and implemented various initiatives to improve their understanding of environmental pathways and conditions. However, a few aspects of environmental pathways and discharges have not been fully analyzed, such as potential threats to the environment posed by waste storage and conveyance systems at LANL, and ongoing liquid discharges to previously contaminated land areas.

G.2.3 Core Function 3 - Establish Controls

LANL has applied appropriate administrative and engineering controls to minimize hazards for many aspects of current site operational activities. Radiological environmental monitoring and surveillance activities at LANL have been implemented consistent with DOE Orders 5400.1 and 5400.5 requirements using a sound and well-documented technical basis. The air, water, and ecology groups within the ESH division conduct routine environmental surveillance of all potentially affected environmental media annually, consistent with the provisions of DOE Orders 5400.1 and 5400.5 and DOE's environmental monitoring and surveillance guidance (DOE EH-0173T). The air program conducts effluent monitoring of stacks consistent with 40 CFR 61 radionuclide NESHAPS requirements and ambient air monitoring using a network of stationary air samplers situated around the site (AIRNET). Data quality objectives, analytical methods, and sensitivities to which the air programs are designed and implemented were noted to be a significant strength, superior to that seen at many other DOE sites, particularly for the ambient air monitoring network. The Water Quality and Hydrology Group performs routine surface water and sediment sampling of representative areas that are potentially impacted by current operations or legacy sources. The Ecology Group performs similar surveillance for remaining media that may be impacted, such as soil, foodstuffs, and biota. Data quality objectives and analytical methods and sensitivities for these programs were also well structured and suitable for determining impacts and distinguishing site-derived radionuclides from natural background. Results from the annual monitoring and surveillance activities are compiled by the respective groups and presented in the environmental surveillance reports published annually. Comprehensive public dose assessments are also performed as part of this process consistent with DOE requirements. Radiological sections of the 2000 report were well organized and comprehensive.

LANL is actively pursuing pollution prevention initiatives to reduce waste generation. The environmental stewardship office has been actively promoting the achievement of pollution prevention objectives in Appendix F of the University of California contract for LANL. Positive aspects of the program include the utilization of a small tax on waste generation to fund pollution prevention projects, recognition programs (e.g., the Green Zia program), and the establishment of a roadmap that sets annual strategies for implementing pollution prevention projects for large or problematic waste streams. Areas for improvement include establishing a specific laboratory policy on pollution prevention, establishing a chargeback system for National Nuclear Security Administration (NNSA)-sponsored waste generators to create waste reduction incentives, and requiring pollution prevention reviews in new laboratory projects.

In general, LANL has established effective administrative controls for waste management activities. Controls include institutional LIRS, LIGs, facility operating requirement documents, and work planning and control procedures. Examples of effective controls include:

- LANL has implemented a waste management coordinators program that provides waste generators with uniform waste management assistance from specifically trained personnel assigned to facilities.

- The LANL waste acceptance criteria (WAC) provide detailed guidance for waste acceptance into storage and treatment facilities on site and/or shipment off site for each of the waste streams generated.

- LANL LIRs and LIGs provide an effective set of requirements and guidance for effectively implementing controls for the management of waste at LANL.

- At CMR, requirements for waste management have been extensively detailed in a requirements document. This document is notable because of the clear articulation of procedural steps, embedded warnings, and decision trees to guide the waste generators in determining the proper controls.

In addition, CMR and RLWTF have implemented effective controls for the management of sanitary waste. These controls include the use of clear plastic bags and training for janitorial staff. Upon pickup from the facilities, as part of the recycling program, LANL sanitary waste is taken to the site's recycling facility where hazardous or radioactive waste items would be removed as part of process to recover recyclable items.

Liquid radiological waste piping within CMR and between CMR and RLWTF has good integrity. Within CMR, radiological waste piping is located in pipe galleries or in trenches that can be inspected for leaks. Detectors are installed within the trenches to alarm at RLWTF in the event of a leak.

RLWTF has effectively implemented controls in response to identified concerns. In response to concerns over potential impacts to groundwater sources, RLWTF has taken steps to limit discharges of some radionuclides to drinking water standards, which is a more conservative limit than derived concentration guidelines (DCGs). These changes have been reflected in the RLWTF WAC and apply to the most mobile radioisotopes, including tritium and strontium-90. The facility has also been aggressive in eliminating non-radiological liquid streams from entering the treatment system, even though such flow reduction can make it more difficult for RLWTF to meet DCGs because less dilution occurs. However, the flow reduction is beneficial from an environmental standpoint because reducing the volume of liquid processed results in a reduction in total amount of liquid that can impact contaminated reaches of Mortandad Canyon. The facility has also recently completed installation of an ion exchange system in anticipation of the promulgation of perchlorate discharge standards. Initial test results show below-detectable levels of perchlorate in the discharge.

Notwithstanding the positive aspects, some areas of environmental controls need improvement, as discussed below.

The LANL LIR on hazard analysis and control for facility work does not contain sufficient guidance for identifying and controlling environmental hazards. For example, the ES&H site hazard and control form in the LIR provides very limited criteria for making an initial identification of environmental hazards associated with work requests. Additionally, the LIR does not contain specifications on the necessary environmental qualification and training for the authorized person. Therefore, the individual may not have the knowledge necessary to identify the need for expert technical support to evaluate the controls necessary for the potential environmental impacts.

DOE Order 5400.5 ALARA requirements have not been formally incorporated into site environmental processes at RLWTF and CMR that generate and discharge radioactivity to the environment. DOE Order 5400.5 requires application of the ALARA process in planning and carrying out all DOE activities. In addition to limiting the dose to members of the public, the order places additional controls on the release of liquid wastes to reduce the potential for radiological contamination of natural resources, such as land, ground, and surface water and ecosystems. The order states that standards for liquid effluent discharges are driven by the DOE ALARA policy, and the objective is to minimize contamination to the environment to the extent practical. LANL has recently issued a newly developed ALARA policy; however, it only addresses public dose and does not to apply the ALARA principle to liquid discharges as required by DOE Order 5400.5.

In some cases, LANL is releasing liquids at or below DCG screening levels without sufficient analysis of ALARA requirements. The concept of DCGs for liquid discharges was introduced with DOE Order 5400.5. As stated in the order, DCGs are not release limits but rather are screening values for considering BAT for liquid discharges and for making dose estimates. Significant successes have been achieved at RLWTF in the past three years using the BAT process and reducing radiological concentrations in discharges to below the DCGs. OLASO has been aggressive in forcing RLWTF to improve treatment technology in order to meet DCGs but has not ensured that LANL strives for further reductions below DCGs. If DCG levels can be met without the use of all treatment phases (e.g., tubular ultrafilter, reverse osmosis), then additional treatment is not performed. For example, because of costs associated with disposition of the secondary waste stream, the reverse osmosis unit is not operated to provide further radiological reduction if DCGs can be met without it. However, no documented ALARA evaluation has been performed to support the use of best available technology at less than optimum efficiency.

The lack of specific knowledge of the magnitude of radiological releases at CMR hinders the ability to establish meaningful ALARA goals and objectives at the activity and facility levels. At CMR, much of the routine radioactivity discharged and conveyed to the RLWTF through the industrial wastewater system is from contaminated rinsewater solutions from the various laboratory facilities. However, CMR does not have a clear or direct method of demonstrating compliance with the RLWTF radionuclide WAC or determining the magnitude of its radiological liquid discharges to RLWTF. There is no sampling of effluent leaving the facility, and radionuclide concentration estimates are based on gross assumptions that are not supported by empirical data or calculation. For example, the waste profile form for liquid waste from CMR sinks and drains lists concentrations of radionuclides at or below the RLWTF WAC, but no calculations are available to support this conclusion. In the laboratories, plutonium residues are removed from glass beakers and the beakers are rinsed several times down the drain. Empirical data regarding the expected quantity of residual plutonium remaining in glass beakers prior to rinsing has not been collected and used in determining projected radioactivity discharges from the various laboratories and resulting concentrations. CMR design included provisions for liquid waste retention tanks that could be used to collect and sample liquid waste prior to discharge. However, the original tanks are single wall and would not be suitable for current routine use due to leak potential. Wings 4 and 5 have been retrofitted with fiberglass tanks because of gravity feed problems in these areas, but these tanks are not used for sampling.

Finding: Environmental ALARA requirements of DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, have not been formally incorporated into site environmental processes at RLWTF and CMR that generate and discharge radioactivity to the environment.

There are a number of outdoor areas around the LANL site that have laboratory-derived radioactivity in the soil or sediments. Some areas contain radionuclides only slightly above background levels, while others have levels that may require future study and/or remediation. For soil that is not releasable in accordance with DOE Order 5400.5, the site's LIR and LIG specify application of radiological controls and posting as a soil contamination area. Soil contamination areas that also contain trackable contamination may also have to be posted as contamination areas. Since isotope-specific concentration limits for unrestricted release have not been published in DOE Order 5400.5 in a manner similar to surface contamination guidelines, sites are expected to derive appropriate soil concentration limits based on the specific isotopes of concern that may be present.

LANL does not currently have a procedure defining site-specific isotope concentration limits considered releasable in accordance with DOE Order 5400.5 and has not evaluated the applicability of soil posting to most outdoor radiological contamination. The Radiation Control organization does not have a systematic mechanism to formally evaluate available soil concentration data against posting requirements and does not have a mechanism to ensure conduct of routine periodic boundary surveys of outdoor source areas to determine whether there have been changes in radiological conditions. In the absence of clear identification and controls for soil contamination areas, specific training and personal protective equipment requirements associated with entry to those areas cannot be consistently implemented at LANL.

A draft document prepared by ESH-12 to provide soil posting implementation guidance for a variety of exposure scenarios is under development but not yet finalized. The derivations in the draft document appear reasonable and consistent with the DOE Order 5400.5 approach. However, posting criteria applicable to potential canyon bottom users are five to six times higher than those for residential, commercial, onsite general employees, resource users, and construction workers. The scenario for the canyon bottom user was included but not altered to ensure consistency with environmental remediation project-derived guidelines for the South Fork of Acid Canyon. The acceptable remediation standards developed for the South Fork of Acid Canyon allow these higher levels of contamination to be unremediated based on limited occupancy assumptions representative of this small and narrow reach of Acid Canyon. However, these assumptions may not be fully protective for potential future users of all area canyons and for the indefinite future. Further, it has not been specified whether the Acid Canyon assumptions or scenario would meet DOE Order 5400.5 unrestricted release guidelines because the land does not belong to DOE and did not follow the DOE Order 5400.5 release approval process.

Finding: LANL soil posting criteria and implementation guidance for environmental contamination have not been sufficiently developed or implemented to ensure that existing soil contamination areas around the site are appropriately identified and controlled in accordance with LANL site radiation protection requirements and expectations.

Overall, LANL has developed and applied appropriate controls for most aspects of its environmental protection program at the facilities examined. Some of the controls are particularly effective. However, ALARA principles have not been included in environmental controls for liquid pathways, and the lack of sufficient soil posting criteria hinders the implementation of controls for areas of radiologically contaminated soil.

G.2.4 Core Function 4 - Work Within Controls

Observations of work activities within RLWTF, CMR, and outdoor areas reviewed during this inspection confirmed that most activities were performed within controls. Radiological work with potential environmental implications was performed consistent with LANL environmental protection expectations and requirements. Actinide chemistry work performed in Wing 5 of CMR was consistent with procedural requirements to recover unused plutonium solution in beakers and dispose of rinsewater into the industrial wastewater system. CMR Wing 9 stack filter changeout was performed in accordance with procedure with no deviations. RLWTF appropriately sampled liquid influent and effluent to ensure that radiological concentrations were below the most restrictive DCG prior to discharge.

Installation of a dedicated water well pump and discharge line in a new alluvial well in Mortandad Canyon was observed for conformance with industry standards. Both the worker safety and technical aspects conformed to standard industrial practices. Water sampling from another nearby alluvial aquifer well in Mortandad Canyon also was performed in accordance with controls.

In the area of waste management, CMR and RLWTF were implementing waste management activities within established regulatory standards and procedures. Hazardous, mixed, and transuranic waste storage areas within these facilities were observed to be effectively managed. For example, facility satellite storage areas were properly posted, waste containers were properly labeled, and storage area waste logbooks contained required information. The less-than-90-day storage area had appropriate access controls, aisle spacing requirements were maintained, flammable wastes were stored inside an appropriate cabinet, containers were appropriately labeled, and required spill response equipment was in place. The liquid hazardous waste containers were inside secondary containment. Transuranic waste drums were properly labeled, were in good condition, and were locked and/or stored in a locked, fenced-off area.

Although these walkdowns identified appropriate waste management practices in the areas observed, internal self-assessments and inspections by New Mexico Environmental Department (NMED) show that LANL faces a continuing challenge in the implementation of waste management storage requirements

In one area, implementation of work activities at LANL was not in accordance with established environmental controls. Areas of environmental radiological contamination are not being properly posted as soil contamination areas consistent with the applicable LANL LIR and LIG. In response to stakeholder concerns, RLWTF erected generic soil contamination area postings near the RLWTF outfall in a known radiologically contaminated area. The generic posting used is not compliant with the site's standard radiological soil contamination area posting delineated in the LIR and contains no information about the radiological nature of the hazard. The telephone number listed on the sign belongs to RLWTF and not the appropriate health physics organization (i.e., ESH-1), which is normally the responsible organization for radiological postings and access.

Overall, work activities within RLWTF, CMR, and outdoor areas inspected during this evaluation were performed consistent with established controls. Both CMR and RLWTF were found during field inspections to be implementing waste management activities in accordance within established regulatory standards and procedures. External (NMED) and internal (LANL ESH division) reviews, however, indicate that continued attention is warranted to ensure full and rigorous implementation of controls. Established controls were not effectively implemented in the posting of known soil contamination areas.

G.3 CONCLUSIONS

Overall, the LANL ISM system effectively incorporates environmental protection considerations. In particular, appropriate requirements for environmental programs have been incorporated by OLASO and LANL in the work smart standards, and most have been appropriately incorporated into LANL directives. LANL has established organizations with clear responsibilities to implement defined environmental protection functions, and has appropriate levels of staff expertise for areas evaluated. With few exceptions, the environmental hazards posed by CMR and RLWTF operations have been appropriately analyzed, including waste generation activities and radiological air emissions. Characterization of the site hydrogeology and the nature and extent of subsurface contamination are progressing, although significant unknowns remain with respect to groundwater contamination and flow mechanisms. LANL has applied appropriate administrative and engineering controls to minimize environmental hazards for many aspects of site operations. For example, the comprehensive radiological environmental surveillance program serves to ensure that adequate controls are in place to protect potential public and environmental receptors. Additionally, LANL has established appropriate administrative controls for waste management and is pursuing pollution prevention initiatives. OA observations of work activities within RLWTF, CMR, and outdoor areas determined that most activities were performed within controls. Both CMR and RLWTF were implementing waste management activities within established regulatory standards and procedures.

While fundamental elements of an effective environmental management system have been established through the LANL ISM system, a number of important gaps exist. Environmental stewardship policies have not been defined for important aspects of environmental programs (pollution prevention and groundwater protection). Current LPRs and LIRs do not address, in a systematic manner, institutional environmental management processes. LANL has not incorporated some DOE order requirements for environmental protection into the applicable LPR and implementing LIRs, contributing to observed process problems. LANL management has recognized the need to strengthen the environmental function within the LANL ISM system, and actions to address identified gaps are ongoing. In several areas, hazards to the environment have not been fully analyzed. LANL has not fully evaluated potential threats to the environment posed by waste storage and conveyance systems. Additionally, ongoing liquid discharges to previously contaminated land areas have not been formally evaluated against DOE Order 5400.5 soil column requirements, which are intended to prevent the continued spread and migration of previously deposited radionuclides in the environment. In several areas, LANL has not pursued appropriate control mechanisms to minimize site impacts and address hazards. DOE environmental ALARA requirements have not been formally incorporated into site environmental processes that generate and discharge radioactivity to the environment, and LANL has not sufficiently developed and implemented appropriate controls for soils contaminated with radionuclides.

While a number of process and implementation deficiencies were identified, most aspects of the systems for analyzing and controlling environmental hazards are effectively established and implemented. LANL management is in the process of addressing many of the concerns identified during this inspection, including establishment of soil posting guidelines, establishment of ALARA policies, and removal/upgrades of some tanks and piping systems with known vulnerabilities. Further, LANL is strengthening its institutional environmental protection functions by development of an environmental protection program plan and through a reorganization that consolidates various environmental protection functions within the laboratory.

G.4 RATING

Environmental Protection..EFFECTIVE PERFORMANCE

G.5 OPPORTUNITIES FOR IMPROVEMENT

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

DOE

1. **Place more emphasis on oversight of environmental radiation protection activities consistent with DOE orders and guidelines.**
   - Delegate responsibility for environmental radiological oversight to an appropriate subject matter expert within OLASO.
   - In the areas of radiological liquid discharges from RLWTF, set contractor performance goals that demonstrate compliance with ALARA.
   - Conduct periodic assessments of contractor activities against the provisions of DOE Orders 5400.1 and 5400.5.

LANL

1. **Enhance the formality of environmental protection programs and policies at LANL.**
   - Formalize the development of environmental stewardship policies and institutional-level management practices. Consider establishment of senior management policy statements in the areas of environmental ALARA, pollution prevention, and groundwater protection.
   - Incorporate DOE order requirements into LPR 404-000-00.0 and appropriate implementing LIRs.
   - Complete development of the draft integrated management plan for environmental protection.
   - Ensure the development of management plans, consistent with LANL quality assurance criteria, to implement functional processes managed at the institutional level (e.g., groundwater protection).

2. **Increase emphasis on accountability and integration of groundwater protection activities for ensuring that all aspects of characterization, monitoring, contamination prevention, remediation, and water supply protection goals are met at the institutional level.**
   - Update and expand the GWPMP to include all aspects of groundwater protection in order to meet DOE Order 5400.1 requirements for describing hydrogeology, documenting monitoring strategy, and establishing groundwater pollution prevention strategies.
   - Develop and apply a risk-based approach for strategic programmatic planning for groundwater protection.
   - Formalize and assign the team of experts on the groundwater integration team to individual aspects of groundwater protection.
   - Finalize and issue the Accelerated Groundwater Protection Action Plan to enhance groundwater protection activities.

3. **Increase emphasis on identification and monitoring of potential contaminant release pathways to the groundwater from operational facilities that use waste storage tanks and associated piping systems.**
   - Perform comprehensive vulnerability assessments at operating facilities that use underground tank and piping systems to identify potential contaminant release pathways to the environment.
   - Identify vulnerabilities to piping systems, tanks, and sumps that can be addressed through equipment upgrades, equipment integrity surveillances, or establishment of shallow groundwater or vadoze zone monitoring systems.
   - Ensure that administrative and engineering controls for monitoring or detecting unplanned releases are followed.

4. **Increase emphasis on integrating environmental ALARA objectives into all site activities that have the potential for environmental impact, including development of environmental ALARA goals and performance measures at the institutional, facility, and activity levels.**
   - Revise and expand new ALARA policy for consistency with DOE Order 5400.5 to include all activities that discharge radioactivity to the environment, including liquid pathways.
   - Establish an environmental ALARA committee with senior management representation. Such a committee should be responsible and accountable for directing LANL environmental strategies and setting goals and performance measures to be implemented at the facility and activity levels (e.g., discharge reduction goals or generator minimization goals).
   - Increase emphasis on pursuing legacy source reduction strategies for contaminated areas, such as canyons, that continue to be impacted by radiological and non-radiological liquid discharges.

5. **Enhance site pollution prevention programs.**
   - Establish a more specific laboratory policy on pollution prevention and waste minimization to raise employee awareness of management expectations.
   - Establish a chargeback system for NNSA-sponsored waste generators to create waste reduction incentives.
   - Revise institutional and facility work planning and control procedures to require pollution prevention reviews in new laboratory projects and research activities.

6. **Increase emphasis on and accountability for ensuring that areas of environmental contamination are properly evaluated and controlled through posting as soil contamination areas if future remediation may be required.**
   - Formalize procedures and implementation guidance, including site-specific radiological soil concentration criteria, for determining soil posting requirements.

- Ensure that proper organizational resources and direction are established to implement the necessary soil posting program as part of health physics or other appropriate organization.
- Establish a mechanism to integrate environmental restoration program site characterization information with health physics operations such that all relevant data are collected and reviewed against soil posting requirements.
- For non-DOE owned land that may meet soil posting requirements, work with stakeholders to establish consensus on responsibilities for soil posting as part of radiological hazard awareness and control obligations.