Volume I

Inspection of
Environment, Safety,
and Health Management
at the

Sandia National Laboratories - New Mexico

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

INDEPENDENT OVERSIGHT
INSPECTION OF
ENVIRONMENT, SAFETY, AND HEALTH MANAGEMENT
AT THE
SANDIA NATIONAL LABORATORIES – NEW MEXICO

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Table of Contents

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Acronyms

AAAHC	Accreditation Association for Ambulatory Health Care
AB	Authorization Basis
ACRR	Annual Core Research Reactor
AHU	Air-Handling Unit
AL	Albuquerque Service Center
AMPL	Advanced Manufacturing and Processes Laboratory
AOP	Administrative Operating Procedure
CAIRS	Computerized Accident/Incident Reporting System
CAM	Continuous Air Monitor
CFR	Code of Federal Regulations
cm^2	Square Centimeter
CO_2	Carbon Dioxide
CPAP	Contractor Performance Assessment Program
CPR	Corporate Process Requirement
CY	Calendar Year
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EPA	Environmental Protection Agency
ES&H	Environment, Safety, and Health
FMOC	Facilities Management and Operations Center
FR	Facility Representative
FRAM	Functions, Responsibilities, and Authorities Manual
FY	Fiscal Year
GIF	Gamma Irradiation Facility
HWMF	Hazardous Waste Management Facility
ISM	Integrated Safety Management
JHA	Job Hazard Analysis
JSA	Job Safety Analysis
JSHE	Job-Site Hazard Evaluation
KIMS	Kirtland Issues Management System
LEL	Lower Explosive Limit
LFL	Lower Flammability Limit
LIWG	Line Implementation Working Group
MDL	Microelectronics Development Laboratory
MOU	Memorandum of Understanding
mrem	Millirem
MSDS	Material Safety Data Sheet
NCAR	Nonconformance Corrective Action Report
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NNSA	National Nuclear Security Administration
NTS	Noncompliance Tracking System
OA	Office of Independent Oversight and Performance Assurance
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
PAAA	Price Anderson Amendment Act

Acronyms (continued)

PEP	Performance Evaluation Process
PPE	Personal Protective Equipment
PHS	Primary Hazard Screening
PISA	Potentially Inadequate Safety Analysis
psf	Pounds Per Square Foot
PNZT	Lead Niobium Zirconium Titanate
PZT	Lead Zirconate Titanate
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RMOC	Risk Management Oversight Council
RMWMF	Radioactive and Mixed Waste Management Facility
RWNMDD	Radioactive Waste/Nuclear Material Disposition Department
RWP	Radiation Work Permit
SAP	Satellite Accumulation Point
SEP	Safety Evaluation Report
SNL	Sandia National Laboratories
SNL/NM	Sandia National Laboratories/New Mexico
SME	Subject Matter Expert
SSO	Sandia Site Office
STSM	Senior Technical Safety Manager
SWTF	Solid Waste Treatment Facility
TQP	Technical Qualification Program
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question

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VOLUME I

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) and emergency management programs at the U.S. Department of Energy's (DOE) Sandia National Laboratories – New Mexico (SNL/NM) site in January-February 2003. 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 the SNL/NM ES&H programs. The results of the review of the SNL/NM emergency management program are discussed in Volume II of this report, and the combined results are discussed in a summary report.

The National Nuclear Security Administration (NNSA) Office of the Deputy Administrator for Defense Programs is the lead program secretarial office for SNL/NM. As such, it has overall Headquarters responsibility for programmatic direction, funding of activities, and ES&H at the site. At the site level, line management responsibility for SNL/NM operations and safety falls under the Manager of the Sandia Site Office (SSO). The Albuquerque Service Center provides support to SSO in several areas (e.g., legal, and human resources) and may provide technical ES&H specialists to support SSO. SNL/NM is managed and operated by Sandia Corporation, under contract to NNSA. Sandia Corporation is a Lockheed Martin Corporation entity.

The primary missions of SNL/NM include activities that support the Department's nuclear weapons stockpile maintenance program and the Department's efforts to reduce the proliferation of weapons of mass destruction, the threat of nuclear accidents, and the potential for damage to the environment. SNL/NM also performs research and development to enhance the reliability of energy and critical infrastructures and to address emerging threats to national security. The SNL/NM site is located on a portion of the Kirtland Air Force Base military reservation in Albuquerque, New Mexico.

SNL/NM activities, which include research and testing, industrial operations, facility maintenance, waste management, and environmental restoration, involve various potential hazards that need to be effectively controlled. These hazards include exposure to external radiation, radiological contamination, hazardous chemicals, explosives, and various physical hazards associated with facility operations (e.g., machine operations, high-voltage electrical equipment, pressurized systems, and noise). Radiological and chemical hazardous materials are present in various forms at SNL/NM.

Throughout the evaluation of ES&H programs, OA reviewed the role of NNSA organizations in providing direction to contractors and conducting line management oversight of contractor activities. OA is placing more emphasis on the review of contractor self-assessments and NNSA line management oversight in ensuring effective ES&H programs. In reviewing NNSA line management oversight, OA focused on the effectiveness of SSO in overseeing SNL/NM contractors, including such management functions as setting expectations, providing implementation guidance, monitoring and assessing contractor performance, and monitoring/evaluating contractor self-assessments. Similarly, OA focuses on

the effectiveness of contractor self-assessment programs. DOE orders require contractors to establish self-assessment programs that review all aspects of ES&H performance.

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 SNL/NM under the direction of SSO. The ES&H portion of the inspection was organized to evaluate four related aspects of the integrated safety management (ISM) program:

- SSO and SNL/NM implementation of selected ISM guiding principles, including line management responsibility for safety (ISM Guiding Principle #1), roles and responsibilities (ISM Guiding Principle #2), personnel staffing, training, and qualifications (ISM Guiding Principle #3), and identification of standards and requirements for SNL/NM (ISM Guiding Principle #5).

- SSO and SNL/NM contractor feedback and continuous improvement systems.

- SNL/NM implementation of the core functions of safety management for various work activities at the Z Pulsed Power Accelerator (Z-Machine), Advanced Manufacturing and Processes Laboratory (AMPL), and Radioactive and Mixed Waste Management Facility (RMWMF), and for selected construction, facility maintenance, and waste management activities. SNL/NM initiatives to meet the new 10 CFR 830, Subpart B, requirements for design safety reviews for nuclear facilities and to achieve accreditation for its occupational medical program were also reviewed.

- Essential system functionality for selected safety-related systems at the Microelectronics Development Laboratory (MDL), including fire protection systems and systems that handle toxic gases used in experiments.

The OA inspection team used a selective sampling approach to determine the effectiveness of SSO and SNL/NM in implementing DOE requirements. The approach involved examining selected institutional programs that support the ISM program, such as SSO and SNL/NM assessment programs. To determine the effectiveness of the institutional programs, the OA team examined implementation of requirements at selected SNL-NM organizations and facilities. Specifically, OA review encompassed work performed by: the Pulsed Power Sciences Center (Organization 1600), which operates the Z-Machine; the Manufacturing Science and Technology Center (Organization 14100), which operates AMPL; the Facilities Management and Operations Center (Organization 10800), which performs various maintenance activities, including maintenance of fire protection systems; the Integrated Safety & Security Center (Organization 3100), which is responsible for ES&H program support and waste management; and the Microsystems Science, Technology & Components Center (Organization 1700), which performs various research activities that use safety-related systems.

As discussed throughout this report, the SNL/NM ISM program has improved, and most work is performed safely. However, work was not always performed in accordance with established requirements and procedures, and some unsafe work practices were observed. Increased SSO and SNL/NM senior management attention is needed to address weaknesses in several important ISM areas, including processes for analyzing hazards and identifying controls, feedback and improvement programs, and implementation of ES&H requirements.

Section 2 of this volume provides an overall discussion of the results of the review of the SNL/NM ES&H programs, including positive aspects and weaknesses. Section 3 provides OA's conclusions regarding the overall effectiveness of SSO and SNL/NM management of the ES&H programs. Section 4 presents the ratings assigned during this review. Appendix A provides supplemental information,

including team composition. Appendix B identifies the specific findings that require corrective action and follow-up. Appendix C presents the results of the review of selected guiding principles of ISM. Appendix D presents the results of the review of the SSO and SNL/NM contractor feedback and continuous improvement processes. Appendix E details the results of the review of the application of the core functions of ISM for the selected SNL/NM activities.

2.0 RESULTS

2.1 Positive Attributes

Several positive attributes were identified in the institutional work control systems. Some aspects of ISM implementation at the facility and activity level were also particularly effective.

Certain aspects of SNL/NM's implementation of the ISM guiding principles are particularly effective. SNL/NM ES&H program and support team staffing, training, and qualifications are effectively managed. Staff qualifications and experience in radiation protection are significant strengths for several SNL/NM organizations. For example, a high percentage of personnel with radiation protection responsibilities at RMWMF had a significant amount of training, expertise, and experience in health physics, and many also had advanced scientific degrees and/or professional certifications in health physics and related safety disciplines. All workers interviewed at the Z-Machine and AMPL were aware of their stop-work responsibilities and authority and indicated they would not hesitate to stop work if they observed or were asked to perform questionable or unsafe work activities. Processes for flowing ES&H requirements down to subcontractors are effective. Health and safety plans for construction and service contractors addressed appropriate ES&H hazards and controls required to safely perform work at SNL/NM.

Certain controls at the Z-Machine and AMPL are particularly effective in ensuring worker and facility safety. Weapons research work at AMPL is well defined in such technical work documents as safe operating procedures and work instructions. Personnel and equipment resources (e.g., local ventilation and laboratory hoods) for conducting research and customer support work at AMPL are sufficient to perform most work safely. At Z-Machine, the facility-level controls are effectively implemented through the safety assessment document, the primary hazard screening process, the facility hazard analysis, and administrative procedures. Most work activities at Z-Machine were safely performed by highly skilled and experienced workers and supervisors using established controls and appropriate personal protective equipment. For example, the Z-Machine coordinator maintained a constant awareness of the status of all subsystems during experiment preparation, and effectively ensured the safety of the machine and workers in the affected area. For SNL/NM maintenance activities, several job-site hazard evaluations for higher-risk work in permitted confined space areas were thorough and comprehensive. Ventilation provisions, exposure measurements, physical safety considerations, and personal protective equipment were correct and well specified.

SSO and SNL/NM are making good progress toward developing a set of enhanced safety basis documents in accordance with 10 CFR 830, Subpart B, requirements. SSO and SNL/NM management are devoting significant attention and resources to implementing the 10 CFR 830, Subpart B, requirements. SSO and SNL/NM have allocated sufficient staff and resources to provide for timely development and review of authorization basis packages, although this effort has required drawing on resources from other organizations. SSO has provided clear expectations for development of authorization basis packages, and is implementing a rigorous review process. SNL/NM has submitted authorization basis packages to SSO for four of the five affected operating facilities for review and approval and is on schedule for the fifth facility. To date, the SSO reviews have resulted in approval of three of the packages and issuance of a conditional safety evaluation report for the fourth. SSO and SNL/NM need to resolve issues regarding the need for revisions to the onsite transportation authorization basis package to ensure that the conditional safety evaluation report is finalized in a timely manner.

The site occupational medical program, which serves the SNL/NM site, successfully renewed their certification following a site visit by the Accreditation Association for Ambulatory Health Care (AAAHC) in December 2002. The accreditation program promotes feedback and quality management

principles through the application of nationally recognized standards and criteria. Originally accredited in 1999, the health services staff have worked diligently to expand medical program services while maintaining quality program principles. Combining both primary health care and occupational medicine have resulted in the overall workforce achieving better health services at lower cost to the company.

SNL/NM has implemented an effective pollution prevention program and is addressing legacy wastes. SNL/NM has successfully implemented a variety of pollution prevention initiatives to reduce and control hazardous waste, radioactive waste, solid waste, water/wastewater, and air emissions. Each generator of hazardous, mixed, radioactive, and municipal wastes is required to identify and analyze the pollution prevention and waste minimization opportunities. Performance measures are used to promote source reduction and resource reuse/recycle. These efforts have resulted in several DOE pollution prevention awards and a White House Closing the Circle award between 1999 and 2002 in the areas of fleet services, affirmative procurement, sustainable design, and energy management. In addition, the Solid Waste Transfer Facility sorts 100 percent of all solid waste to ensure that no unauthorized wastes are offered for disposal. SNL/NM is aggressively working to identify and address legacy wastes.

SSO management recently took a number of proactive actions to address challenges associated with the transition to a site office. SSO managers recognize the need to restructure SSO to implement its new and expanded site office responsibilities while concurrently dealing with numerous changes in organizational interfaces, management expectations, and policies, as well as vacant staff positions and a hiring freeze. SSO is taking positive steps to capitalize on the experience of other NNSA organizations in assessing the status of its current programs and developing plans and procedures for future operations. For example, SSO used external expertise during its recent self-assessment activities and 10 CFR 830, Subpart B, activities. SSO also has actively solicited assistance from other NNSA organizations in developing its line management processes and procedures.

2.2 Program Weaknesses

Although the framework for the SNL/NM ISM program is in place, weaknesses were identified in some important aspects of ISM management systems and work control processes. In addition, certain aspects of SSO and SNL/NM feedback and improvement systems need improvement.

SNL/NM line management systems for communicating ES&H expectations and monitoring performance are not effectively implemented and are not providing sufficient assurance that ES&H expectations are consistently met and that work activities are performed safely. SNL/NM institutional and division-level systems are not functioning effectively in all cases and thus are not providing the expected degree of assurance that operations will be conducted safely. For example, higher-tier documents, such as the ES&H Manual, often provide broad guidance that is not adequately interpreted and translated to lower-tier requirements. In addition, procedures (or other technical work documents) are not consistently used and are not always followed when used.

SSO and SNL/NM feedback and improvement processes are not effective. SSO has made limited progress in addressing weaknesses in SSO assessments of contractor performance and issues management and corrective action processes in the areas of ES&H and emergency management. SSO line management oversight responsibilities are not clearly defined or effectively implemented; established assessment schedules are not being met; and issues management and corrective action management processes are not effective. SNL/NM formal assessments of line ES&H performance lack sufficient frequency, focus, and rigor to provide assurance that safety programs are being adequately implemented as required by DOE and SNL/NM requirements. For example, assessment processes do not adequately focus on ES&H elements and observing work activities. SNL/NM issue management processes and

implementation are insufficient to ensure consistently appropriate and timely identification, documentation, evaluation, resolution, and recurrence control for deficiencies in ES&H and emergency management programs. ES&H deficiencies are not always properly documented, investigated, and reported. Analysis of deficiencies is not sufficient to identify adverse trends, the extent of condition, causes, and recurrence controls. Further, management has not always ensured that corrective actions are timely and effective. A particular concern is that SSO is planning to reduce the scope and frequency of some line management oversight activities, such as Facility Representatives, based on their expectation that the SNL/NM feedback and improvement programs will provide assurance of safe operations. However, the SNL/NM feedback and improvement programs have longstanding weaknesses that are not being effectively addressed.

SNL/NM's implementation of the core functions of safety management has weaknesses in several important processes and is not effectively implemented, resulting in several unsafe work practices that place workers at unnecessary risk. Incorrect assumptions in the SNL/NM primary hazard screening process have resulted in non-conservative facility/activity hazard classifications; consequently, the appropriate level of hazards analysis, review, and approval is not always performed. SNL/NM work control processes are not sufficiently documented to explain how activity-level hazards and controls are to be identified, analyzed, and documented, and how hazard controls are to be linked to activity-level hazards. Several concerns with institutional controls were identified, including a lack of guidance in some sections of the ES&H Manual, a non-conservative approach to implementing some lockout/tagout requirements, and inadequate waste management controls in the line organizations to ensure an effective characterization of waste type. SNL/NM safety programs are not effectively implemented, and operating procedures are not followed in the areas of lockout/tagout, excavations, fall protection, the confined space program, and the pressure safety program. There were several instances of unsafe work practices and failures to follow procedures and implement program requirements. Weaknesses in a number of ES&H programs (e.g., lockout/tagout) could result in serious injuries to workers, and indicates a need for additional management and safety organization involvement in day-to-day work activities and programs.

The SNL/NM unreviewed safety question (USQ) procedure contains errors that could lead to non-conservative decisions, and the USQ process has not been properly implemented in all cases, resulting in USQ packages that do not include all of the required information and analysis. The USQ procedure has several logic errors that, if followed verbatim, could lead to non-conservative USQ disposition. Twelve of 14 USQs performed under the new procedure did not have sufficient information to independently confirm the conclusions. In one case, a correct USQ determination was made (a positive USQ) but the "Potentially Inadequate Safety Analysis" (PISA) process was not entered as required by the SNL/NM procedure and 10 CFR 830 requirements.

SNL/NM and the waste management subcontractor have not ensured sufficient formality in implementation of the radiological controls at RMWMF consistent with the requirements of the ES&H Manual (e.g., job-specific radiation work permits or equivalent) such that all controls are clearly identified, documented, and understood by workers and all ES&H personnel responsible for radiological safety. The radiological control process at RMWMF is not being implemented in a manner that ensures that all controls are clearly identified, documented, and understood by workers prior to performing work, as required by the ES&H Manual. In addition, ineffective communications mechanisms between the line and ES&H personnel have affected the ability to properly evaluate some radiological controls, resulting in the potential to adversely affect the ability to make proper decisions in such areas as internal dose assessments, bioassays, and assigned internal dose.

SNL/NM has not established rigorous management and supervisory processes that ensure essential systems are designed and maintained in accordance with applicable codes, standards, and DOE orders, leading to a potential reduction in the reliability of SNL/NM essential systems. Testing,

maintenance, and surveillance of SNL/NM fire protection systems do not fully meet the applicable DOE requirements and National Fire Protection Association codes and standards in a number of cases. Although these deficiencies do not represent an immediate concern that would prevent the fire protection and alarm systems from performing as designed in the event of a fire, several elements of the SNL/NM fire protection program (inspection, surveillance, testing, maintenance, and configuration management) are not sufficiently rigorous and effective. In addition, there are a number of design weaknesses in the modifications to the new toxic gas distribution system. Although these weaknesses do not currently have a safety impact because the bunker is not operational, they indicate a need for a more effective design review process.

3.0 CONCLUSIONS

NNSA, SSO, and SNL/NM senior management are supportive of safety, understand and accept their line management responsibility, and have adequately defined most aspects of their roles and responsibilities. In most cases, SSO and SNL/NM personnel have good experience, qualifications, and training, although SSO needs to continue addressing staffing shortages. The DOE/Sandia Corporation contract identifies an appropriate set of requirements, which have been incorporated into higher-level policies for SNL/NM.

Many aspects of work at SNL/NM were performed consistent with the core functions of ISM. Some of the engineering controls and many administrative controls were well designed and effectively implemented. SSO and SNL/NM are making good progress toward developing a set of enhanced safety basis documents in accordance with 10 CFR 830, Subpart B, requirements and have met all schedule milestones to date. Some engineering controls, such as ventilation systems and hoods, were effectively designed and maintained to protect workers. Safety processes for Z-Machine operations were comprehensive and rigorous. SNL/NM has effectively communicated ES&H requirements to subcontractors through subcontract provisions and safety plans. The site medical program has achieved renewal of its initial accreditation from an external association. Several aspects of the pollution prevention program are notable and have received awards. The overall material condition of the fire protection systems appears adequate, and the recent upgrades enhance system reliability and performance.

However, weaknesses were identified in the SNL/NM processes for analyzing hazards and identifying controls. Further, work was not always performed in accordance with established requirements and procedures, and several unsafe work practices were observed. SSO and SNL/NM have not been fully effective in ensuring that requirements are effectively communicated and implemented at the working level consistent with ISM requirements. Weaknesses were identified in several aspects of SNL/NM ES&H programs, including the ES&H Manual, the primary hazard screening process, the USQ process, work control processes for programmatic work and maintenance, radiological work control processes at RMWMF, and procedural adherence. Deficiencies were also identified in the implementation of such ES&H programs as lockout/tagout processes, excavations, fall protection, the confined space program, and the pressure safety program. For fire protection systems, some applicable DOE requirements, fire protection codes and standards, and testing and maintenance requirements are not fully met, reducing assurance that the systems will operate reliably.

SSO and SNL/NM implement several feedback and improvement processes. Many assessments and inspections are performed, corrective actions are taken to address assessment findings, and lessons learned are developed and communicated to workers. However, there are weaknesses in SSO line management oversight processes and SNL/NM assessment and issues management processes that hinder their effectiveness, especially in reporting and managing the evaluation and resolution of safety deficiencies. Increased management attention is needed to ensure that SSO and SNL feedback and improvement programs are enhanced and that longstanding weaknesses and obstacles to success (e.g., interface between ES&H and line organizations) are resolved. Although limited in scope, SNL/NM has piloted a promising comprehensive program for conducting ES&H functional area and program self-assessments that could serve as a model for other organizations.

In most cases, SSO and SNL/NM have a good understanding of the identified weaknesses and have initiated corrective actions for some. However, a number of weaknesses in ES&H processes and programs warrant management attention, with particular attention on enhancing worker safety and addressing longstanding weaknesses in assessments and issues/corrective action management.

4.0 RATINGS

The ratings reflect the current status of the reviewed elements of the SNL/NM ISM program:

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 Responsibilities EFFECTIVE PERFORMANCE
Guiding Principle #5 – Identification of Standards and Requirements.....EFFECTIVE PERFORMANCE

Feedback and Improvement

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

SNL/NM Implementation of Core Functions for Selected Work Activities

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

Essential Systems Functionality

Design .....NEEDS IMPROVEMENT
Configuration Management.....NEEDS IMPROVEMENT
Surveillance and Testing .....NEEDS IMPROVEMENT
Maintenance.....NEEDS IMPROVEMENT

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APPENDIX A

Supplemental Information

A.1 Dates of Review

Scoping Visit	October 15 - 17, 2002
Onsite Inspection Visit	January 27 - February 7, 2003
Report Validation and Closeout	February 18 - 20, 2003

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
Thomas Staker, Deputy Director, Office of Environment, Safety and Health Evaluations

A.2.2 Quality Review Board

Michael A. Kilpatrick
Charles B. Lewis
Patricia Worthington
Dean C. Hickman

A.2.3 Review Team

Patricia Worthington, Director, Office of Environment, Safety and Health Evaluations (Team Leader)

Safety Management Systems and Feedback and Improvement Systems
Ali Ghovanlou (Topic Lead)
Bob Freeman
Al Gibson
Bernie Kokenge
Tim Martin
Bob Compton

Essential Systems
Brad Davy (Topic Lead)
Charles Campbell
Don Prevatte

Core Function Implementation Team
Bob Freeman (Topic Lead)
Vic Crawford
Mike Gilroy
Ching-San Huang
Marvin Mielke
Mark Good
Jim Lockridge
Michael Shlyamberg
Edward Stafford
Mario Vigliani

A.2.4 Administrative Support

Mary Anne Sirk
Tom Davis

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APPENDIX B

Site-Specific Findings

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

FINDING STATEMENTS	REFER TO PAGES
1. SNL/NM line management systems for communicating ES&H expectations and monitoring performance are not effectively implemented and are not providing sufficient assurance that ES&H expectations are consistently met and that work activities are performed safely.	19
2. SSO has made limited progress in addressing weaknesses in SSO assessments of contractor performance and issues management and corrective action processes in the areas of ES&H and emergency management.	35
3. Formal assessments of line ES&H performance lack sufficient frequency, focus, and rigor to provide assurance that safety programs are being adequately implemented, as required by DOE and SNL/NM requirements.	37
4. SNL/NM issue management processes and implementation are insufficient to ensure consistently appropriate and timely identification, documentation, evaluation, resolution, and recurrence control for deficiencies in ES&H and emergency management programs.	41
5. Incorrect assumptions in the SNL/NM primary hazard screening process have resulted in non-conservative facility/activity hazard classifications; consequently, the appropriate level of hazards analysis, review, and approval is not always performed.	51
6. The SNL/NM unreviewed safety question (USQ) procedure contains errors that could lead to non-conservative decisions, and the USQ process has not been properly implemented in all cases, resulting in USQ packages that do not include all of the required information and analysis.	52
7. SNL/NM work control processes are not sufficiently documented to explain how activity-level hazards and controls are to be identified, analyzed, and documented, and how hazard controls are to be linked to activity-level hazards.	59
8. SNL/NM and the waste management subcontractor have not ensured sufficient formality in implementation of the radiological controls at RMWMF consistent with the requirements of the ES&H Manual (e.g., job-specific radiation work permits or equivalent) such that all controls are clearly identified, documented, and understood by workers and all ES&H personnel responsible for radiological safety.	62
9. SNL/NM safety programs are not effectively implemented, and operating procedures are not followed in the areas of lockout/tagout, excavations, fall protection, the confined space program, and the pressure safety program, resulting in several unsafe work practices that place workers at risk unnecessarily.	68
10. SNL/NM has not established rigorous management and supervisory processes or systems that ensure that essential systems are designed and maintained in accordance with applicable codes, standards, and DOE orders, leading to a potential reduction in the reliability of SNL/NM essential systems.	82

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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 selected guiding principles of integrated safety management (ISM) as applied at the Sandia National Laboratories – New Mexico (SNL/NM). OA examined Guiding Principle #1 (Line Management Responsibility for Safety), Guiding Principle #2 (Clear Roles and Responsibilities), Guiding Principle #3 (Competence Commensurate with Responsibilities), and Guiding Principle #5 (Identification of Standards and Requirements). These guiding principles were selected based on a review of SNL/NM's past performance and the status of the ISM program.

National Nuclear Security Administration (NNSA), Sandia Site Office (SSO), SNL/NM, and subcontractor 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. The OA team reviewed various documents and records, including the SNL/NM ISM system description; associated procedures; Functions, Responsibilities, and Authorities Manuals (FRAMs); the SNL/NM Environment, Safety, and Health (ES&H) Manual; contract provisions related to safety; subcontract provisions; and various SNL/NM plans and initiatives. In the evaluation of the guiding principles, OA considered the results of the OA review of the core functions and essential systems.

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, the workers, and the environment.

NNSA and SSO

NNSA management recognizes its line management responsibility for safety. NNSA recently (December 2002) implemented a new organizational structure, which was based on an extensive reengineering effort. One of the primary objectives of the reengineering was to streamline the line management chain so that there was a clear line of responsibility and accountability for mission activities and implementation of DOE requirements, including ES&H requirements.

In the past year, policy development has been a major focus of NNSA's implementation of its line management responsibilities. NNSA had issued a number of new policies with important implications for SSO line management and SNL/NM ES&H programs. For example, NNSA issued a new policy entitled Corporate Performance Evaluation Process for Management and Operating Contractors (NAP-4, October 2002) that establishes a uniform process for evaluating NNSA management and operating contractor performance. NNSA has also issued policies on ES&H management guidance, standards management, and occupational safety and health for Federal employees.

In the NNSA organizational structure, SSO is one of eight NNSA sites offices and has assumed many responsibilities that were previously performed by the Albuquerque Operations Office (AL). These new responsibilities include important line management functions, such as managing the contract, evaluating contractor performance, and reviewing and approving various SNL/NM ES&H plans and safety basis

documents. The former AL has transitioned to a service center and is responsible for supporting SSO and other NNSA site offices in a variety of areas (e.g., legal, and human resources). The Albuquerque Service Center supports SSO in the ES&H arena by providing subject matter experts (SMEs) and technical expertise. A support service agreement between SSO and the service center is being developed to define and formalize management expectations for service center support to SSO.

Within NNSA, SSO is clearly assigned line management responsibility for safety at SNL/NM. SSO management clearly understands and accepts this responsibility. SSO management also recognizes that significant efforts are needed to enhance the capabilities of SSO to the point where it can fully and effectively implement its expanded set of ES&H responsibilities. SSO is taking a number of steps toward enhancing its capabilities, including evaluating its near-term and long-term staffing needs, identifying needed additional technical staff positions, developing ES&H line management oversight plans and associated procedures, and performing self-assessments to provide a baseline for needed improvements. As discussed under Guiding Principles #2, #3, and #5 and in Appendix D, these initiatives are in various stages of development and implementation.

SSO managers recognize the need to restructure SSO to implement its new and expanded responsibilities, which include analyzing the new functions, analyzing resource needs to accomplish those functions, developing staffing plans, organizing its staff, and developing procedures. SSO has begun such efforts and has made some progress, but faces considerable challenges in concurrently dealing with numerous changes in organizational interfaces, management expectations, and policies at a time when SSO has a number of vacant staff positions and is under a hiring freeze. SSO also recognizes the benefits of capitalizing on the experience of other NNSA organizations in assessing the status of its current programs and developing plans and procedures for future operations. For example, SSO used external expertise during its recent self-assessment activities. SSO also has actively solicited assistance from other NNSA organizations in developing its line management processes and procedures.

Currently, SSO is effectively implementing some aspects of its line management responsibility for safety. The Facility Representative (FR) program is functioning to keep SSO management aware of the day-to-day status of SNL/NM facilities and operations, and SSO has effectively implemented its responsibilities relating to the development and review of an enhanced set of safety basis documents for SNL/NM nuclear facilities, in accordance with 10 CFR 830, Subpart B, requirements. SSO has requested and is receiving ES&H support from the Albuquerque Service Center SMEs to mitigate recognized technical staff shortages in some disciplines.

However, SSO currently does not have sufficient programs and processes in place to fully and effectively implement its line management responsibilities in some areas. SSO processes for assessments of SNL/NM ES&H performance are not well defined, and the implementing procedures are either not complete or not adequate. SSO is currently performing some of its responsibilities, such as self-assessments, in an ad hoc fashion without the benefits of a structured self-assessment program that has clear objectives and milestones. (See Finding #2 in Appendix D.)

The new set of NNSA policies will have significant implications for NNSA site operations. SSO had only broadly examined the implications of the new set of NNSA policies and recognizes the challenges associated with their implementation at SNL/NM. However, SSO has not yet developed a comprehensive approach for implementation of the new policies. In addition, SSO has not formulated and communicated specific expectations for SNL/NM relating to contractor actions to implement the new policies, causing some confusion within SSO and in interactions between SSO and SNL/NM. For example, SNL/NM is directed to track certain performance indicators, but some of those performance indicators are redundant.

SNL/NM

SNL/NM senior management demonstrates commitment to safety in a number of areas. The SNL/NM Vice President for Division 3000 is the process owner of the ES&H Manual and has been actively involved in its refinement. SNL/NM strategic and institutional plans emphasize safety and endorse the ISM policy. The Sandia Corporation Board of Directors regularly tracks safety performance at SNL/NM including quarterly briefings on ES&H performance from SNL/NM management. The Risk Management Oversight Council (RMOC), a corporate level committee chaired by the SNL/NM Executive Vice President, has included ES&H as an area of focus for the committee's deliberation and follows up on ES&H deficiencies that are brought to its attention by the corporate audit group. Individual accountability for safety has been incorporated into the annual performance appraisal standards of SNL/NM Vice Presidents, and through the "line-of-sight" which flows down responsibilities and accountability to subordinate levels of management and staff. With the support of SNL/NM management, SNL/NM has a large number of safety committees that discuss ES&H issues and provide expertise and feedback to SNL/NM programs and line managers.

SNL/NM management has supported efforts to involve workers in ES&H programs and has an adequate stop-work policy. Interviews with workers and union representatives reveal that SNL/NM workers strongly believe that management is concerned about their safety and that SNL/NM is a safe place to work. The SNL/NM Stop Work Process clearly states the conditions where work shall be stopped or suspended until appropriate remedial actions are taken. Observations by the OA team confirm that SNL/NM managers are supportive of the stop-work policy, and that the workers are not reluctant to stop work when they believe it is appropriate.

SNL/NM has established an appropriate set of top-tier ES&H policies and has communicated these policies through second-tier directive mechanisms, such as the ES&H Manual, the ISM system description, the corporate process requirement for conduct of operations, and the environmental management program plan. In some cases, sitewide policies are effective and have been supported by SNL/NM senior management across the site. For example, the SNL/NM has established and is implementing a pollution prevention policy that is being integrated into the ISM program; SNL/NM has received several awards for its sitewide pollution protection approaches.

However, in many instances, the higher-tier policies do not provide adequate direction and expectations (e.g., minimum requirements) to the SNL/NM divisions and centers for developing third-tier requirements documents (called technical work documents at SNL/NM and including procedures and wide variety of other work instructions). The technical work documents are intended to define the requirements that need to be implemented to ensure safe conduct of specific types of work activities. For example, the ES&H Manual requires divisions to perform self-assessments of ES&H in their facilities but provides little direction as to the expectations for division-level self-assessment programs (e.g., minimum frequency of assessments, scope of review, or processes for addressing deficiencies). As a result, the quality of third-tier requirements documents varies considerably and is not always adequate. In many cases, SNL/NM line management at the division and center level has not devoted sufficient attention to the quality of the third-tier documents to ensure that they result in effective implementation of ES&H requirements. At the institutional level, SNL/NM senior management has not taken sufficient action to ensure that all divisions and centers fully understand and implement the requirements.

The SNL/NM higher-tier policy/requirement documents (such as the ES&H Manual) policies are designed to allow the various SNL/NM divisions and centers considerable autonomy and flexibility in determining how the higher-tier direction will be implemented. In management approaches that provide maximum flexibility to subordinate divisions, it is important to have adequate institutional systems that provide assurance of safe operations and that verify that all subordinate divisions have adequately tailored

the higher-tier requirements to their operations. Some of the most important institutional systems that SNL/NM management relies on to provide such assurance include:

- Requirements and expectations that flow down from the contractual requirements to higher-tier documents (e.g., ES&H Manual) and then to the division and activity level through division-specific technical work documents.

- Adherence to established requirements within the line organizations, including systems for communicating expectations to workers (e.g., procedures, training, and supervisors) and ensuring that resources/funding are available to meet the established requirements, such as the integrated enabling services processes, which determine the funding level for ES&H activities and set the tone for upper management expectations.

- Identification and correction of ES&H deficiencies by various assessment mechanisms (including ES&H customer support team members who have been deployed to support line management, and ES&H coordinators who are responsible for conducting assessments) and issues management systems that are used to track deficiencies.

- The Line Implementation Working Group (LIWG), which is assigned responsibility for resolving ES&H issues that crosscut divisional boundaries and other issues that cannot be readily resolved within one division.

However, the institutional systems are not functioning effectively in all cases and thus are not providing the expected degree of assurance that operations will be conducted safely. For example:

- The higher-tier documents, such as the ES&H Manual, often provide broad guidance that is not adequately interpreted and translated to lower-tier requirements.

- The integrated enabling services explicitly emphasize mission efficiency and service excellence, but do not emphasize management expectations for safe operations.

- Procedures (or other technical work documents) are not consistently used and are not always followed.

- Division management and supervisors have not consistently ensured that requirements defined in procedures (or other work instructions) must be followed, and that work is to be stopped to correct the procedure if the requirements cannot be implemented as described.

- The LIWG has not been effective in resolving some of the important ES&H issues, such as ES&H assessments across all divisions.

- Line management self-assessments of ES&H requirements (performed by line organizations and supported by ES&H customer support teams) do not focus sufficiently on work activities to determine whether requirements and expectations are being met.

- Divisions and centers do not sufficiently solicit and use ES&H expertise from outside their organization to provide assessments, review of processes and procedures, and supplemental support on technical issues.

- There are weaknesses in the SNL/NM feedback and improvement programs at the institutional and division levels that hinder their effectiveness, including ineffective issues management and corrective action management processes.

The weaknesses above are not evident at all SNL/NM activities but were observed across several different organizations, types of work, and ES&H programs. As such, they represent a management-level weakness that extends beyond any single division and warrant a sitewide approach to resolution. In addition, resolution of the noted weaknesses will require senior SNL/NM management attention and direction that extends across divisions. SNL/NM senior management has taken some appropriate steps toward addressing this finding, such as the efforts to strengthen ES&H assessments through LIWG actions. However, the LIWG does not have necessary authority to effect resolution and has only dealt with portions of the problem.

Finding #1. SNL/NM line management systems for communicating ES&H expectations and monitoring performance are not effectively implemented and are not providing sufficient assurance that ES&H expectations are consistently met and that work activities are performed safely.

As discussed in Appendices D, E, and F, many aspects of SNL/NM's implementation of requirements were deficient and in some cases resulted in a number of observed unsafe work practices. Many of these deficiencies occur and recur because of the combined effects of the above weaknesses in the systems management relies on to provide assurance of safe operations.

Summary of Guiding Principle #1

NNSA has implemented its reorganization to streamline and improve line management responsibility and accountability for mission and safety and is proving policy direction to its site offices. SSO management understands and accepts its line management responsibility for safety, has some elements of an effective line oversight program, and is effectively supporting 10 CFR 830, Subpart B implementation efforts. However, SSO currently does not have sufficient programs and processes in place to fully and effectively implement its line management responsibilities in some areas, such as ES&H assessments.

SNL/NM senior management demonstrates commitment to safety in a number of areas, and has supported efforts to involve workers in ES&H programs. SNL/NM has also established an appropriate set of top-tier ES&H policies and has communicated these policies through second-tier directive mechanisms. However, SNL/NM line management has not adequately ensured that the higher-tier policies are effectively implemented at the working level in all cases. Many of the observed deficiencies in ES&H programs are the result of a combination of factors, such as insufficient communication of expectations and insufficient assessments of work activities. Increased senior SNL/NM management level attention will be needed to resolve these factors.

C.2.2. Clear Roles and Responsibilities

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.

SSO

As part of its reengineering process, NNSA has established a number of policies that will significantly impact the roles and responsibilities of NNSA site offices, including SSO, such as NAP-4, *Corporate*

Performance Evaluation Process for Management and Operating Contractors. The NNSA Administrator issued a January 2003 memorandum that describes the broad roles and responsibilities of the site offices and service center within the new organizational structure and clarifies responsibilities for "critical functional areas," such as start-up and restart of nuclear and non-nuclear facilities and ISM.

SSO senior management is fully aware of the challenges associated with transitioning to the new NNSA structure, including organizational realignments and the need to develop or update numerous program documents and procedures. Development of the ISM description document and FRAM was initiated several months ago, but these documents have not yet been finalized. SSO staff indicated that their effort had been hampered by uncertainties regarding recent organizational realignments, including those related to the roles and responsibilities of the newly established service center. SSO management had not yet examined the implications of several new NNSA policies and had not formulated a transition plan for implementing these policies. SSO's current focus is to acquire necessary resources and correct deficiencies identified in recent assessments.

The roles and responsibilities of FRs are adequately defined and documented, and focus on continuing awareness for work planning and control processes and conduct of operations. Roles and responsibilities for SSO personnel supporting the implementation of 10 CFR 830, Subpart B requirements, which establish milestones for authorization basis (AB) enhancements, are also adequately defined in procedures and are being adequately implemented.

However, roles and responsibilities for other SSO staff with ES&H responsibilities, such as SMEs, are currently not well defined or documented. SSO recently published its ES&H implementation plan, which was developed to serve as a procedure for SMEs and attempts to define and document specific SME roles and responsibilities. A set of lower-level procedures is currently being developed to define the roles and responsibilities for specific ES&H functional areas. Although a good step forward, the Plan and draft lower-level procedures are not sufficiently detailed to establish clear responsibilities and expectations for SSO SMEs.

The process and roles and responsibilities for providing performance feedback to the contractor through performance assessment methodology, and the contractor performance assessment program had in the past been defined in AL procedures. Currently SSO is in the process of re-evaluating the usefulness of these processes for evaluating the contractor. After determining whether and how these methods will be used in the future, SSO plans to convert AL procedures, if necessary, to define processes and roles and responsibilities.

SSO uses the contractor performance evaluation process (PEP) to score contractor performance against annually established and negotiated performance objectives. This process is consistent with the parameters of the recent NNSA policy (NAP-4). Within SSO, the roles and responsibilities for preparation of the PEP are well defined. The PEP for fiscal year (FY) 2003 was prepared by SSO, reviewed and approved by NNSA/DOE Headquarters (HQ), and recently forwarded to SNL/NM. The new PEP is based on the NNSA approach emphasizing the "focus on critical few" and is considerably less detailed than the FY 2002 performance appraisal agreement. In the FY 2003 PEP, the performance objective for "operations" broadly incorporates ES&H performance but does not provide detailed ES&H expectations. These expectations need to be defined before appropriate functions and roles and responsibilities for this process can be delineated.

SNL/NM

Institutional Roles and Responsibilities. Institutional roles and responsibilities for ES&H are generally well defined and adequately address safety in most areas. Lockheed Martin Corporation and SNL/NM

corporate policies assign roles and responsibilities for ES&H and establish senior management commitment to the protection of workers, the public, and the environment. Mechanisms are in place for communicating the status of ES&H activities to corporate levels of these organizations in the form of performance metrics that track ES&H performance; regular briefings by the Vice President, Human Resources & Protection Services, to the SNL/NM Board of Directors on ES&H performance; and quarterly reports that provide the status on line implementation of ES&H.

The roles and responsibilities of the RMOC have been clearly assigned and formalized and provide a mechanism for executive management monitoring of important areas, including ES&H. The roles and responsibilities of various safety committees having both line and safety representation are formalized in charters and provide the basis for addressing new requirements in specific safety areas and for providing input to the ES&H Manual. The SNL/NM ISM system description and ES&H Manual provide a broad definition of roles and responsibilities and establish the framework for ES&H programs at the institutional level and the basis for ISM implementation within SNL line organizations.

Institutional ES&H programs provide ES&H expertise and services to the line organizations for implementing ES&H requirements through customer support teams and ES&H coordinators that support line organizations. The roles and responsibilities of these functions are defined in general terms in the ES&H Manual. The roles and responsibilities for establishing and maintaining ES&H programs, such as environmental management, industrial hygiene and safety, radiation protection, and waste management are delineated in multiple program documents. Some of these documents, such as those associated with the radiation protection program, clearly define roles, responsibilities, and authorities for program implementation and management in a logical hierarchical order. However, for some programs, the roles, responsibilities, and authorities are not defined with sufficient specificity. For example, the roles, responsibilities, and authorities describing the industrial hygiene program are not clearly defined in the Industrial Hygiene Program document or in lower-tier documents associated with specific Industrial Hygiene subprograms. The SNL/NM has recognized this as an area of weakness in some of the institutional ES&H programs and has initiated an effort within the ES&H organization to revise these documents using the 10 quality criteria of DOE Order 414.1A (which are also included in 10 CFR 830, Subpart A, which is applicable to some SNL/NM operations) as the basis for revision. This effort is reflected in the responsible manager's 2003 Performance Management Form.

SNL/NM established the LIWG as a mechanism for implementing ISM across SNL and coordinating ES&H requirements and mission requirements and priorities. However, the LIWG has not been fully effective in ensuring that line organizations implement effective and rigorous self-assessment, issues management, and corrective action programs. For example, the LIWG has not been effective or timely in addressing the recognized need to enhance assessments of the implementation of ES&H programs by line organizations. (See Appendix D.)

The fire protection program is managed for the institution within the Facilities Management & Operations Center (FMOC). Although the roles, responsibilities, and authorities for the fire protection program are described in the Corporate Fire Protection Program document, it does not completely identify all organizational interfaces and related responsibilities of all involved SNL/NM organizations. Most of the organizations having important program responsibilities, such as maintenance, testing, inspection, installation, and emergency management, reside outside of the Fire Protection Engineering organization (10863), where primary responsibility for the Fire Protection Program is assigned. The involvement of multiple organizations reinforces the need to establish effective organizational programmatic interfaces through clearly defined roles, responsibilities, and authorities. Many of the fire protection program deficiencies (see Appendix F) are partially attributable to unclear and undocumented responsibilities for the various organizations. For example, personnel were not fully aware of all their maintenance responsibilities, such as those included in internal lease agreements. Many management and supervisory

systems-related deficiencies were identified, including failure to meet National Fire Protection Association (NFPA) standards, lack of procedures, inadequate record keeping and records retention, and failure to perform tests of fire protection systems.

Work Authorization Roles and Responsibilities. Roles and responsibilities of line managers, ES&H coordinators, and customer support teams for authorizing work are broadly described in the ES&H Manual. The specific processes used to authorize work are the responsibility of line management. Although informal and inadequately documented in some instances (See Appendix E), most aspects of these processes are functioning adequately and appropriately involve line management, workers, ES&H coordinators, and customer support teams. The roles and responsibilities of ES&H coordinators and customer support teams in support of authorizing work are defined in various division and center roles and responsibilities documents, work agreements, and internal lease agreements. The roles and responsibilities spelled out in the ES&H Manual provide an adequate, broad framework for providing ES&H support services to line organizations.

However, the effectiveness of the flowdown of the broad responsibilities in support of specific work activities varies in effectiveness among the various SNL/NM organizations and among individual positions. For example, the roles and responsibilities of facility operators at RMWMF and the accelerator activities coordinators at the Z Pulsed Power Accelerator (Z-Machine) are clearly defined and ensure facility readiness in support of work authorization and experimental activities. At RMWMF, facility operators have been formally assigned the responsibility of conducting daily checks of building systems using checklists. At the Z-Machine, an accelerator activities coordinator has been formally assigned the role of conducting pre-shot and post-shot checks of the facility using checklists.

The ES&H Manual and division-specific roles and responsibilities documents describe the general responsibilities of the ES&H coordinators and customer support teams. In some cases, these documents adequately identify specific responsibilities, such as reviewing primary hazard screenings (PHSs). However, neither the manual nor lower-tier documents specifically define certain responsibilities that ES&H coordinators and customer support teams are performing in support of the line organizations' work authorization process. For example, ES&H coordinator responsibilities for reviewing work packages are not sufficiently described in the ES&H Manual or lower-tier documents.

Subcontractor Roles, Responsibilities, and Accountability. The roles and responsibilities of individuals responsible for ensuring that the subcontractor meets ES&H requirements have been appropriately defined and implemented at RMWMF to ensure subcontractor accountability for ES&H performance. The roles, responsibilities, and authorities of the SNL/NM delegated representative for monitoring the subcontractor at RMWMF are defined in the SNL/NM Procurement Manual and Radioactive Waste/Nuclear Material Disposition Department training program documents. The PEP used with the waste facility operating subcontract at RMWMF effectively uses performance measures that incorporate safety performance as part of the performance award fee determination process. The subcontract requires the SNL/NM delegated representative and SNL/NM management team to monitor subcontractor activities.

Accountability. The SNL/NM performance appraisal process for individuals serves as an effective mechanism for holding managers and staff accountable for ES&H performance. The performance appraisal process incorporates the "Line of Sight" process in establishing individual performance expectations. The Line of Sight process links all levels of the organization to corporate goals and objectives of the SNL/NM Operating Plan, which include ES&H goals and objectives. The performance management form documents how the individual's objectives are linked to corporate objectives. A total of 15 completed performance management forms for line managers, SNL/NM delegated representatives, ES&H coordinators, and technical staff were sampled and found to appropriately address ES&H as an

area of performance accountability. Furthermore, SNL/NM has an institutional procedure in place that holds individuals accountable when they fail to follow safety rules and applies progressive disciplinary actions based on the nature and seriousness of the offense.

Summary of Guiding Principle #2

Within SSO, roles and responsibilities are adequately defined for some important functions, such as FRs and support for 10 CFR 830, Subpart B, implementation. Roles and responsibilities for other important functions, such as assessments of ES&H performance by SSO SMEs, are not well defined and currently are not effectively implemented. SSO management recognizes that significant work remains to develop and/or update the program plans and procedures necessary to effectively define expectations for its new and expanded set of responsibilities as a NNSA site office.

Institutional roles and responsibilities for ES&H and implementation of ISM are broadly defined in corporate policies, various safety committee charters, and the ES&H Manual. Although adequate in most areas, they should be strengthened in areas related to ES&H program documentation and the fire protection program. SNL/NM lacks a mechanism (e.g., a committee or group of managers endorsed by senior management) with clearly defined roles, responsibilities, and authorities for addressing crosscutting, systemic, or recurring ES&H weaknesses. The roles and responsibilities of ES&H coordinators and customer support teams for providing ES&H services to line organizations are well defined, but lack specificity regarding the support they provide to line organizations in the authorization of work. Roles and responsibilities have been assigned and implemented for ensuring facility readiness as part of the work authorization processes within line organizations. Roles and responsibilities are well defined in the subcontract for maintenance and operations of RMWMF, and mechanisms are in place for holding individuals and the RMWMF subcontractor accountable for safety performance.

C.2.3 Competence Commensurate with Responsibilities

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

SSO

SSO is significantly understaffed for their assigned responsibilities as a result of attrition, the current hiring freeze, and the assumption of new direction, coordination, and oversight responsibilities as a site office for Sandia sites in New Mexico, California, and Nevada, and smaller operations at Pantex and Kauai. SSO has 63 NNSA staff members, including 6 interns, with a ceiling of 75. The Albuquerque Service Center and NNSA continue to provide detailees and matrixed staff to mitigate some of the key technical staff shortages. SSO anticipates near-term lifting of the current hiring freeze and approval to fill the 12 existing vacancies.

A January 2003 workforce analysis by SSO identified the need for 22 new critical staff positions (3 of which could be converted from current positions), which would correspond to 7 full-time-equivalent positions over the current ceiling. The workforce analysis is based partly on a shift in SSO's oversight focus to higher hazard facilities and activities; an assumed relaxation of DOE-STD-1063, allowing a reduction in FR coverage; and continued support from the service center and program office. The analysis is also based on the assumption that SNL/NM will become significantly more effective in safety program implementation, performance problem identification, self-assessment, and feedback and improvement, and thus will require less SSO oversight. However, the results of this OA inspection (see Appendix D) and other recent internal and external assessments identified weaknesses in current SNL/NM feedback and improvement processes. In addition, the plan to focus on higher-hazard facilities

could result in insufficient coverage of facilities and hazards that are lower risk from the standpoint of public safety but that often have significant worker safety hazards (e.g., electrical shock) and typically are the facilities where most injuries occur. Line management oversight of worker safety is particularly important at SNL/NM, which has one of the higher injury rates in the DOE complex.

Under the new workforce analysis, the current FR staffing level of 8 will be maintained. SSO line management oversight of Tech Area V reactors will continue with the current 2 FRs, who are expected to be fully qualified in March. The remaining 6 FRs will shift their principal line management oversight focus to the 19 facilities that are defined as moderate hazard facilities by SSO's risk ranking for FR coverage (DOE-STD-1063-200, *Facility Representatives*). However, the current FR and SME staffing and utilization have not been sufficient to provide effective line management oversight of SNL/NM activities, as demonstrated by the unresolved deficiencies in SNL/NM ISM and ES&H programs and performance identified by the OA team (see Appendix E). Additionally, an FR staffing study in 1997 using the guidance contained in DOE-STD-1063 determined the need for 22 FRs. A November 2000 FR program staffing report indicated that management determined that a FY 2003 FR staffing level of 12 was reasonable. Agreement has not been reached on how the responsibility for vital system engineers will be staffed in response to DOE's implementation plan for Defense Nuclear Facilities Safety Board Recommendation 2000-2. NNSA is working to revise DOE-STD-1063-2000 to reflect less need for FR oversight based on expected enhanced performance of management and operating contractors.

SSO has established and is implementing an effective process for staffing teams for review of updated AB documents, required by 10 CFR 830, Subpart B (see Appendix E). Each review is preceded by the development of a review plan for the updated AB document, which details team selection and member qualification, the review criteria checklist, and the schedule and process for generating the safety evaluation report. A typical team is composed of SMEs from SSO, the NNSA Albuquerque Service Center, SNL/NM, Los Alamos National Laboratory, and support contractors. Personnel are selected based on their qualifications and experience in similar facility operation/safety and/or nuclear facility safety basis functional areas. The review plan and process provides an appropriate level of assurance of the competence and independence of the assembled review teams, and the adequacy of review resources for timely development of a safety evaluation report that documents the results of the review.

The technical qualification program (TQP) applied to SSO is well designed and documented. As implemented, the TQP applies to all SSO technical positions, their supervisors, and support staff whose actions can impact ES&H. Training, qualification, continuing training, and re-qualification requirements are customized for each position based on required competencies, and the resulting systematic-approach-to-training-based program meets the requirements of DOE Order 360.1A. The FR TQP is particularly well structured and implemented. Six of the eight current FRs are fully qualified, and the remaining two FRs are on track for full qualification for their Tech Area V assignments early this year.

Two of three designated senior technical safety manager (STSM) position incumbents are fully qualified; however, the third STSM designee has only completed 30 percent of qualification requirements, despite a completion due date in May 2001. No compensatory measures letter was in place, and management has not ensured an unbroken chain of fully qualified STSMs in positions of authority for the responsibilities of the delinquent individual, as described in DOE Manual 426.1-1.

Although the SSO technical staff are generally experienced and well educated, only 50 percent of TQP designees were fully qualified by the end of calendar year (CY) 2002. Although this is an improvement over the 30 percent at the beginning of CY 2002, it continues to fall short of DOE's expectation of at least 75 percent. In addition, 20 percent of those staff members who were issued new qualification standards

had not yet completed their self-evaluation of listed required competencies to determine what effort remained to complete qualifications.

A Federal Technical Capabilities Panel Agent TQP self-assessment was completed in September 2002, as required by DOE Manual 426.1-1. Corrective actions for identified process and program deficiencies were due at the end of December 2002, but only a few have been completed. The Albuquerque Service Center Training Manager indicated that some corrective actions were not complete because future expectations for the TQP remain to be defined, and the NNSA Training and Development Department Manager position has not yet been filled. In addition, most designated TQP qualifying officials who had been found deficient in completing required reading, which is necessary for qualification for those positions, had failed to resolve those deficiencies. Further, the corrective action plan did not provide for verification that involved staff were adequately qualified, despite the self-assessment findings. Overall, SSO management has not devoted sufficient attention and priority to their TQP to ensure that the technical staff and managers are competent commensurate with assigned responsibilities.

SNL/NM

SNL/NM ES&H program and customer support team staffing, training, and qualifications are effectively managed by Department 3120 managers and supervisors. The recent initiative to establish a five-year strategic skills and hiring plan appropriately addresses the need to plan for projected attrition and potential changes in ES&H support needs. Only two critical SME vacancies were identified (electrical safety and explosive safety), and both were being mitigated by assigning collateral duties to other staff members and their managers. Concern for future attrition of highly qualified safety engineers is addressed by teaming recent hires with limited experience with mentors charged with developing these future staff assets.

Turnover of radiological control technicians (RCTs) continues to be a challenge because of the time required to train new hires and the market for their services at other nuclear sites. As a result, RCT training courses are conducted periodically to approximate a just-in-time pipeline of qualified RCTs for anticipated vacancies.

ES&H customer support team managers proactively assure that appropriate numbers, competencies, and skill mix are maintained to meet line organization requirements for safety professional support. Longer-term trends in ES&H customer support team staffing are addressed in development of work agreements with input from all affected parties, development of existing staff to take on emerging challenges, and carefully filling vacancies and well-justified new positions with individuals having competencies that best meet current and future needs. Customer assessment of the adequacy of support is routinely solicited in customer satisfaction surveys. The preliminary results from the recent customer satisfaction survey indicate general customer satisfaction with the number, competency, and skill mix of the teams.

SNL/NM has established a generally effective process for staffing and assuring the competence of appropriate teams for the development and review of updated facility AB documents required by 10 CFR 830, Subpart B. Unreviewed safety question (USQ) training is required for reactor operators and selected technical staff responsible for developing USQ determinations, and for those managers responsible for approval of the determinations. Tech Area V managers determined that additional training for staff members updating and maintaining AB documents was unnecessary, given their level of qualifications, knowledge, and experience. The allocation of resources to the AB effort has been sufficient to ensure that required updated documents can be submitted on schedule.

SNL/NM ES&H training and qualification requirements are defined in the ES&H Manual, supplemental hazard-specific program documents, facility- and organization-specific requirements derived from

primary hazard screenings and hazards analyses, and various technical work documents. SNL/NM managers were generally knowledgeable of training program requirements and understood that each individual's training requirements included SNL/NM site requirements, assigned facility and organization requirements, and manager-defined requirements applicable to the tasks and activities to be assigned. Training requirements and records for each individual are adequately tracked in the SNL/NM Training and Employee Development System database or other custom databases created for individual organizations.

SNL/NM management expectations of supervisory response to staff deficiencies in meeting refresher or re-training requirements are not consistently described or adequately understood. Inadequate response to lapsed training requirements could allow individuals to continue to perform assigned work without a basis for assuring competence. In the ES&H portion of the inspection, the OA team did not identify any instances of an individual doing work for which training had expired; however, the emergency management portion identified instances of personnel with questionable qualifications (see Volume II). The ES&H Manual requires each level of line management to ensure that its workers are competent commensurate with assigned responsibilities. Divisions 1000 and 2000 have a process for handling situations in which an individual's training lapses. FMOC's documented training policy assigns responsibility to the first line supervisor to preclude individuals from working in areas where they do not fully meet applicable training requirements. However, one interviewed FMOC manager was not aware of this assigned responsibility. AMPL and RMWMF managers reportedly understand the appropriate expectations, but are unaware of any specific division or center document that addresses the issue. The Z-Machine operating and maintenance subcontractor has a very clear process that removes the access authority of individuals to enter certain areas of the Z-Machine once any applicable training requirement for that access expires, but does not have documented guidance for when other training requirements expire. Finally, Z-Machine works under a 1996 multi-center procedure that states that a manager can deem an operations individual "qualified to perform his job without supervision" if the individual is at least 85 percent compliant with all required training previously identified by the manager from corporate, and applicable primary hazard screening training requirements. However, this procedure does not ensure that the individuals have sufficient and current training.

Although some enhancements in training programs are needed (e.g., ensuring that supervisors appropriately respond to lapsed training), the OA team determined through interviews, document reviews, and work observation that SNL/NM personnel and their contractors with ES&H responsibilities were generally well qualified, trained, and experienced. However, as discussed in Appendices D and E, there are many deficiencies in implementation of ES&H programs and processes. OA's review indicates that these deficiencies stem primarily from weaknesses in requirements and the establishment and communication of expectations, and generally not because individuals lack the competence to perform assigned responsibilities.

Summary of Guiding Principle #3

SSO is understaffed for their assigned responsibilities as a result of attrition, the current hiring freeze, and the assumption of new direction, coordination, and oversight responsibilities as a site office. Progress in completing staff TQP requirements has been limited, and additional management attention and priority is needed to meet DOE expectations. SSO has requested additional staff and anticipates near-term approval to fill vacancies up to their current ceiling level. Actions recently taken and planned to improve staff utilization, risk-based focus, assessment formality, and feedback to the contractor are appropriate measures to improve line management oversight effectiveness. SSO has established appropriate plans and obtained sufficient staff to effectively support 10 CFR 830, Subpart B, implementation at SNL/NM; however, this required drawing on resources from other organizations. SSO needs to re-evaluate the adequacy of its staffing plans in light of the significant increases in assigned SSO responsibilities, the

need for vital system engineers, the need for the technical staff to devote additional time to complete their TQP, site safety performance, and the current weaknesses in many aspects of SNL/NM assurance programs.

SNL/NM ES&H program and support team staffing, training, and qualifications are effectively managed. Further, other SNL/NM personnel and their contractors with ES&H responsibilities are generally well qualified, experienced, and trained. However, management expectations for response to lapses in required staff training are not uniformly understood. The ES&H program and performance deficiencies identified by the OA team do not appear to reflect a lack of staff competence, but more likely reflect deficiencies in ES&H program expectations and requirements for adherence, in assignment of responsibilities and authorities, and in the quality, rigor, and effectiveness of feedback and improvement processes. As SNL/NM addresses these deficiencies, modifications and enhancements to staffing, training, and qualification programs may be needed to ensure that management expectations are understood and effectively implemented.

C.2.4 Identification of 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.

SSO

SSO has imposed appropriate safety standards and requirements on SNL/NM through the DOE/Sandia Corporation Contract. When SSO assumed responsibility for management of the contract in December 2002, the contract contained appropriate safety requirements. Few changes have been made to the contract since that time because of a moratorium on changes, which has been in place for about a year. The set of requirements in the contract has remained appropriate, although several of the DOE directives referenced by the contract are no longer the most current revisions. The unincorporated revisions are of minor safety significance. SSO has authority to change requirements in the contract during the moratorium if necessary to ensure safety, but such changes have not yet been necessary; however, SSO has not assigned responsibilities or established procedures for identifying the need for such changes. SSO is taking steps to update procedures and responsibility assignments.

The SSO procedure for requirements management, like many other SSO procedures, has not been updated to reflect the recent reorganization and additional SSO responsibilities. In general, SSO procedures are not consistently controlled, and most do not yet reflect the roles and responsibilities recently assigned to SSO. SSO does not have a formal process for managing requirements applicable to the Federal staff as will be required for implementation of the new NNSA policy on standards management (NAP-5).

SNL

External ES&H requirements are transmitted to the SNL workforce through three levels of documents. The first two levels are applicable to all SNL/NM employees. Level 1 documents provide institutional policies and principles, and Level 2 documents, which include the ES&H Manual, specify corporate-level requirements that apply across SNL/NM. Level 3 documents are division-specific and lower-level, and include technical work documents that define hazards and controls to be applied at the task level.

SNL has developed a systematic process for flowing down ES&H requirements from the DOE/Sandia Corporation contract to the ES&H Manual. The formal process has ensured that changes to safety requirements in the contract are incorporated into the ES&H Manual in a timely manner. A less formal process has been established for identifying changes to applicable regulations and for informing responsible staff members of these changes. SMEs are expected to stay abreast of changes to industry standards and to update the ES&H Manual when appropriate, and at least every two years. Although processes in these areas are informal, they have been effective in maintaining SNL/NM documents current with external requirements. However, many SNL documents were not up-to-date with respect to internal changes. For example, they contained references to internal documents that no longer existed, references to obsolete SNL organization numbers, and descriptions of activities no longer performed.

Flowdown of ES&H requirements from Level 2 institutional documents to Level 3 technical work documents has not been effective. Technical work documents are the principal documents through which SNL/NM specifies controls for identified hazards. The ES&H Manual, and supplements to this manual, assign responsibility for development of technical work documents and provide guidance and direction for determining the need for these documents. However, there are few requirements governing content of these Level 3 documents. While this approach provides the individual divisions and centers with a large degree of flexibility, the absence of requirements regarding the content of Level 3 documents results in a situation where the quality of Level 3 documents relies on the knowledge and experience of the individuals. As a result, the quality of these documents varied considerably and was not always adequate to ensure that hazards are controlled or that processes were adequately defined and implemented. Examples of numerous deficiencies in technical work documents and self-assessment procedures that are discussed further in Appendices D, E, or F include:

- The AMPL work control process is not adequately documented or comprehensive.

- Procedures for maintenance and testing of Microelectronics Development Laboratory fire protection systems lack sufficient detail to ensure compliance with NFPA requirements.

- Approved work plans at RMWMF did not specify all relevant hazards and controls, and in some cases specified inconsistent controls for similar hazards.

- Requirements and procedures for conducting self-assessments and for issues management and corrective action management are not clearly delineated in division or center instructions, and self-assessments have not been effective.

ES&H requirements have been adequately flowed down to subcontractors. The requirements to implement ISM and the SNL ES&H Manual have been appropriately incorporated into subcontracts for maintaining and operating the Z-Machine and RMWMF. Flowdown of ES&H requirements to service and construction subcontractors has also been adequate. The effective flowdown of requirements to subcontractors is partly attributable to a SNL/NM philosophy that everyone working on the SNL/NM site will follow SNL/NM policies. This approach ensures that workplace requirements are consistent for all workers.

Medical services for subcontracted workers are provided primarily through a medical subcontractor. Provisions are needed to ensure that records are retained and that SNL/NM is informed of any adverse trends.

SNL has not performed an assessment of the effectiveness of the requirements management program. CPR400.1.2.2, *Process for Flowdown and Tailoring of Requirements and Standards that Support*

Sandia's Integrated Safety Management System, requires line organizations to perform periodic assessments to confirm that requirements and standards are documented, communicated, understood, and followed. Self-assessments performed by line organizations have focused primarily on compliance with requirements and have not addressed the other aspects of this requirement.

Summary of Guiding Principle #5

SSO has established an adequate set of baseline safety requirements in the contract to control the hazards at SNL/NM. SNL/NM has established processes and a hierarchy of formal documents for tailoring external requirements and transmitting them to the workforce. Most external requirements have been effectively incorporated into institutional-level documents. However, flowdown of these requirements from the institutional level to the task level through Level 3 documents has not been fully effective.

C.3 CONCLUSIONS

NNSA, SSO, and SNL/NM are supportive of safety, understand and accept their line management responsibility, and have adequately defined most aspects of their roles and responsibilities, including support for 10 CFR 830, Subpart B, efforts. In most cases, SSO and SNL/NM personnel have good experience, qualifications, and training, although SSO needs to continue addressing current staffing shortages. The DOE/Sandia Corporation contract identifies an appropriate set of requirements, which have been incorporated into adequate higher-level policies for SNL/NM.

However, improvements are needed in certain areas. SSO and SNL/NM have not been fully effective in ensuring that requirements are effectively communicated and implemented at the working level, consistent with ISM requirements. Many of the observed deficiencies in ES&H programs are the result of a combination of factors, such as insufficient communication of expectations, and less-than-adequate assessments of work activities. Increased SSO and SNL/NM senior management-level attention will be needed to resolve these factors.

C.4 RATINGS

The ratings of the guiding principles reflect the status of the reviewed elements of the SNL/NM 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 Responsibilities EFFECTIVE PERFORMANCE
Guiding Principle #5 – Identification of Standards and Requirements.....EFFECTIVE PERFORMANCE

C.5 OPPORTUNITIES FOR IMPROVEMENT

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

SSO

1. **Continue to benchmark SSO operations against other NNSA site offices to assess the status of current programs and to capitalize on potential solutions for needed improvements.** Specific actions to consider include:

   - Review corrective action database systems for documenting FR and SME operational awareness activities to identify lessons learned, to ensure data quality, and to ensure viability of the system as an effective management tool for tracking and trending.

   - Review assessment plans and guidance cards.

   - Review training programs for courses related to performance-based assessment and evaluation of work planning and control processes to strengthen FR and SME capabilities to develop detailed assessment plans and perform more in-depth work observations.

   - Have knowledgeable managers and ES&H personnel from other NNSA site offices mentor and/or participate on SSO oversight activities to increase the experience base on how to observe work and identify deficiencies.

SNL/NM

1. **Establish a mechanism at the institutional level that is chartered and endorsed by senior SNL/NM management to effectively address ES&H deficiencies**. Specific actions to consider include:

   - Designate a group of managers (designated by senior management) that includes representation from line and ES&H organizations. Clearly define the group's responsibilities and its authority to effectively address ES&H deficiencies across the SNL/NM.

   - Specifically include as part of the designated group's responsibilities implementation of effective self-assessment, corrective action, and issues management programs, including addressing institutional barriers to effective ES&H performance assessments within line organizations.

   - Hold line managers accountable for implementing actions directed by the designated group using the Line of Sight and performance management form mechanisms.

2. **Prepare and/or revise SNL/NM documents to clarify roles, responsibilities, and authorities related to institutional ES&H programs and support of work authorization processes within the line organizations** . Specific actions to consider include:

   - Complete the revision of ES&H program documents using the 10 quality criteria of DOE Order 414.1A as the basis for revision. Focus on clarifying the roles, responsibilities, and authorities related to ES&H program management and implementation.

   - Completely identify all SNL/NM organizations that comprise the SNL/NM Fire Protection Program, and document the program roles, responsibilities, and authorities of each organization and associated positions. As part of that process, define the interfaces among all involved organizations. Ensure that responsibilities for meeting applicable NFPA and other program requirements are formally assigned to organizations and positions.

- Revise division and center roles and responsibilities documents and work agreements to reflect the specific roles and responsibilities of ES&H coordinators and customer support teams in support of the work authorization processes as defined by the various line organizations.

- Establish clear and consistent requirements for the actions to be taken by first line supervisors in response to notification or recognition that a member of their staff is no longer current with training, refresher training, or retraining requirements that were established for the purpose of assuring competence commensurate with assigned responsibilities.

- Ensure that medical providers who perform occupational medical services for subcontracted workers have mechanisms to ensure that medical records are preserved and lines of communication are established to report any significant health trends.

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APPENDIX D

Feedback and Continuous Improvement (Core Function 5)

D.1 INTRODUCTION

The Office of Independent Oversight and Performance Assurance's (OA) evaluation of feedback and improvement at Sandia National Laboratories – New Mexico (SNL/NM) included an examination of the programs and performance of the Sandia Site Office (SSO) and the SNL/NM contractor, the Sandia Corporation, which is managed by the Lockheed Martin Corporation. The OA team examined SSO line management oversight of integrated safety management (ISM) processes and implementation of selected SSO line management oversight functions, including the Facility Representative (FR) program and environment, safety, and health (ES&H) assessments. The OA team reviewed SNL/NM institutional feedback and improvement processes, including assessments and inspections, corrective action/issues management, lessons learned, and employee concerns. Selected SNL/NM activity-specific feedback and improvement processes, such as post-job reviews and application of lessons learned, were also reviewed to determine how effectively institutional programs are implemented.

D.2 RESULTS

D.2.1 SSO Line Management Oversight

SSO's ES&H feedback and improvement program includes the FR program, assessments of SNL/NM ES&H programs, self-assessments, and issues management and corrective action processes. The National Nuclear Security Administration (NNSA) conducted an assessment of the SSO feedback and improvement program in March 2002, which identified a number of weaknesses in the FR program, ES&H assessments, and issues management and corrective actions processes.

SSO does not have a structured self-assessment program but has performed several self-assessments in the past year. These self-assessments have helped SSO management better define and characterize the weaknesses identified by the March 2002 NNSA assessment and determine SSO progress in addressing the NNSA findings.

SSO has made some progress in addressing the identified weaknesses in the FR program. FRs have developed and implemented processes for providing performance-based reports to the contractor on a quarterly basis. Most FRs have achieved Phase II qualifications. In addition, FRs and SSO subject matter experts (SMEs) have increased efforts to coordinate their activities, including daily management meetings involving FRs and SMEs. SSO FRs and SMEs are receiving training to improve their understanding of SNL/NM ISM program processes, with emphasis on work planning and control. Although progress has been made, most of the improvements in the FR program have occurred within the past few months, and the FR program has not yet reached the required level of maturity and stability. Also, FR staffing remains a concern, as discussed in Appendix C under Guiding Principle #3.

Through its recent self-assessments, SSO has identified the need to enhance its procedures as a first step toward improving the rigor and quality of its assessments. SSO identified the need for better procedural guidance for its assessments of SNL/NM ES&H management systems as well as improvements in the use of the criteria review and acceptance document and communication of deficiencies to the contractor. SSO recently issued its ES&H management plan to provide direction for ES&H line management oversight and assessment activities. SSO also determined a need for a SSO management walkthrough program to

ensure that SSO managers are aware of conditions, issues, and deficiencies in SNL/NM facilities for which they have responsibilities. SSO has recently finalized a procedure to set expectations for SSO managers to conduct periodic walkthroughs in the field with SSO staff and SNL/NM counterparts.

Although some progress has been made, SSO does not yet have a structured and effective process for performing assessments and management walkthroughs of SNL/NM ES&H programs and facilities. Weaknesses in the current programs include:

- The recently issued ES&H management plan does not provide a clear roadmap for SMEs to implement an effective assessment program. It does not have the needed formality or structure, and it lacks a clear and detailed definition of roles and responsibilities. The plan does not provide sufficient specific information about SSO expectations for the assessment program so that SMEs understand what needs to be done and how to do it. SSO is currently developing a set of procedures to complement this plan, and is requiring SMEs to develop specific assessment plans for their areas of responsibility for each assessment.

- The established assessment schedules are not being met. The ES&H plan identifies a schedule for planned inspections. However, schedule slippages are occurring, in part because assessment program processes have not been adequately defined and communicated to SMEs (e.g., processes for communicating assessment results to the contractor). In addition, the SSO assessment schedule was not sufficiently coordinated with SNL/NM self-assessment schedules. Although many assessments were planned, only three of the planned assessments have been conducted to date, and the reports for these assessments are not yet finalized.

- Walkthroughs by SSO managers have been limited to date, in part because of coordination issues and demands placed on SSO managers as a result of the recent NNSA restructuring.

In addition, SSO continues to have weaknesses in its issues management and corrective action management processes. SSO has not yet established appropriate mechanisms to address internal and external issues, commitments, and associated corrective actions. Tracking and closure of issues and findings from both internal and external assessments continues to be weak. Specific deficiencies include:

- SSO has not defined the basic elements of an effective issues management and corrective action process. SSO has not yet established an office-wide expectation for issues management and corrective action processes (i.e., policies, procedures, and processes) for how internal and external issues, commitments, and associated corrective actions are to be communicated and managed.

- Corrective actions for the recent NNSA assessment and self-assessments are being handled separately, using various tracking processes. Although this situation is recognized by SSO managers, SSO has not attempted to crosswalk the various issues and findings to determine the actions needed to fully address the concerns in a systematic and integrated fashion.

- SSO has not clearly communicated expectations for use of the Kirtland Issues Management System (KIMS) database, limiting its effectiveness as a tracking and trending tool. The KIMS users manual has not been updated to reflect management expectations. Clear expectations for format, content, and generation of management reports have not been promulgated to improve consistency and usefulness of the database. A review of KIMS entries indicated inconsistencies in the discussion of deficiencies.

Although some progress is being made (e.g., FRs are using KIMS more often), the longstanding weaknesses in issues and corrective action management continue to exist. These weaknesses are a barrier

to improvement as they hinder SSO's progress in addressing deficiencies identified by previous assessments and making the needed improvements. For example, deficiencies with the KIMS database have been identified in a number of recent assessments; however, SSO has not developed a set of corrective actions to improve the quality of the KIMS database.

Similar weaknesses were identified in SSO line management oversight of emergency management programs. The program for evaluating SNL/NM emergency management performance is not well defined and the processes for communicating findings to the contractor and tracking corrective actions are also not fully and effectively implemented. For the most part, SSO has self-identified the weaknesses in its emergency management assessments and issues management processes and has developed corrective action plans. Significant work remains to complete the corrective actions and verify their effectiveness.

Finding #2: SSO has made limited progress in addressing weaknesses in SSO assessments of contractor performance and issues management and corrective action processes in the areas of ES&H and emergency management.

D.2.2 SNL/NM Feedback and Improvement Systems

Assessments. SNL/NM institutional requirements specify some of the needed elements of a comprehensive assessment program. Section 22A of the SNL/NM ES&H Manual requires all managers to ensure that ES&H self-assessments of facilities, operations, and activities are planned, scheduled, and performed. SNL/NM requirements specify that these self-assessments include watching work and collecting feedback from workers when applicable. Management surveillances are required in accordance with Corporate Process Requirement (CPR) 400.1.1.4. Formality of Operations Manual CPR0001.3.3 requires management to ensure that self-assessments are performed against all applicable requirements, goals, and expectations. Criteria 9 and 10 of CPR001.3.2, *Corporate Quality Assurance Program,* require that managers assess their programs and the effectiveness of their processes and that independent assessments be conducted to evaluate work performance. This CPR also states that senior managers must ensure that they receive objective feedback to confirm acceptable performance and to identify improvement opportunities.

A wide variety of independent and management self-assessments and inspection/surveillance activities are conducted at SNL/NM. These include assessment activities performed at the corporate and institutional level, division/center level assessments and management walkthroughs, and reviews by ES&H SMEs.

Some aspects of corporate- and institutional-level assessments are being implemented as required and are identifying deficiencies and needed improvements. Lockheed Martin Corporation conducts annual external assessments of ES&H. The SNL/NM Audit Center (12800) conducts several safety-related independent assessments annually, as required by CPR001.3.5, *Audits, Assessments, and Appraisals.* Several self-assessments of the corporate quality assurance (QA) program were conducted in calendar year (CY) 2002. These assessments were generally comprehensive and were thoroughly examined against clearly defined criteria.

At the division/center level, regular assessments are performed, and some of these are appropriately focused on performance of work activities. Division and center ES&H coordinators organize and participate in annual ES&H facility walkthrough inspections with the ES&H staff and division, center, and department managers. Supervisors in the Facilities Management and Operations Center (FMOC) conduct monthly documented work observations of their crew activities, including application of lockout/tagout. Matrixed and support ES&H personnel also perform inspections, surveys, and

investigations to evaluate working conditions in SNL/NM facilities. Day-to-day monitoring of activities and conditions provides continuous feedback on performance.

ES&H program reviews are performed by the Integrated Safety & Security Center (Center 3100). The scope of these program reviews has recently been expanded and strengthened. This program now provides for assessments of 82 functional areas in 12 ES&H program areas. This assessment process, with two areas piloted in CY 2002, is detailed in a comprehensive program plan, and assessments are scheduled annually.

In the waste management arena, the various feedback and improvement mechanisms are effectively implemented for the most part. For example, the SME for hazardous waste from Department 3124 (Hazardous and Solid Waste) conducts annual Resource Conservation and Recovery Act (RCRA) assessments of all waste management facilities, including radioactive waste operations that have RCRA requirements (mixed waste operations) at the Radioactive Waste/Nuclear Material Disposition facilities.

Although many assessment activities are conducted at SNL/NM and some aspects are effective, weaknesses in assessment programs have impacted SNL/NM's effectiveness in evaluating safety performance and driving continuous improvement. As discussed below, some of the weaknesses are the result of insufficient requirements and expectations, but many identified weaknesses occur because established requirements are not fully or effectively implemented by line managers.

The institutional CPR documents define only the most basic expectations for performing management assessments. They do not adequately define expectations for an effective program such as the necessary minimum scope of assessments and process parameters. Although the Corporate Integrated Management Report is regularly used to provide ES&H information and performance data to SNL/NM management, there are no institutional requirements for the preparation and use of this report. Section 22A of the ES&H Manual has not been kept current and does not correctly reference certain requirements, such as requirements for performing walkdowns.

Although a variety of assessments are performed by the centers and divisions, many aspects of these assessments do not meet the established requirements or are not effectively implemented. Most line ES&H self-assessments are performed only once each year and consist of walkthrough inspections that focus on physical conditions. Management surveillances, often performed concurrently with the ES&H assessments, are also focused on physical conditions. Most assessments are not planned or conducted to address specific ES&H topical areas as specified in ES&H Manual Section 22A. Assessments rarely address such ISM systems as assessments, corrective action, lessons learned, requirements flowdown, or work control. Optional question sets and content guidance documents attached to the ES&H Manual and the QA program CPR are seldom used to plan or perform line self-assessments.

With few exceptions, current SNL/NM processes (e.g., line self-assessments, management surveillances, and Center 3100 pilot functional area assessments) do not place sufficient emphasis on observation of work activities to determine compliance with requirements and procedures. Observation of work activities and process implementation inspections are important assessment tools for determining whether processes are implemented as required and are effective in protecting the public, workers, and the environment. (See Appendix E for deficiencies and unsafe work performance identified through observation of work.)

Historically, assessments of ES&H program implementation have primarily been performed by the SNL/NM line organizations, with support from ES&H SMEs matrixed to the line. The line organizations have usually not requested the ES&H organization to perform assessments of ES&H program implementation, and few such assessments have been performed. Several recent external and internal

assessments indicate a need for line organizations to share more self-assessment information and to seek more reviews of ES&H programs by ES&H specialists outside the line organizations. ES&H performance evaluation of SNL/NM line activities is an item being evaluated by the Line Implementation Working Group (LIWG), with the goal of developing an integrated line/support ES&H implementation review protocol. However, progress on this item has been limited in the past year.

Numerous weaknesses in SNL/NM's assessment programs have been identified during the last two years by various internal organizations, such as LIWG, the Quality Program Office, the Price Anderson Amendment Act (PAAA) Integration Department, and the QA Working Group, and by both internal and external bodies as part of the Governance/Assurance Model initiative. These reviews directly or indirectly indicated that the SNL/NM assessment programs are not effectively implemented. While some actions are being taken (e.g., expansion of ES&H program reviews), weaknesses persist and are recurring. Most corrective actions to date have been taken by individual divisions and have not been consistently effective. Crosscutting institutional feedback and improvement processes, such as for management assessment and corrective action/issues management, have not been assessed by the Corporate Independent ES&H and Quality Audit organization.

Finding #3: Formal assessments of line ES&H performance lack sufficient frequency, focus, and rigor to provide assurance that safety programs are being adequately implemented, as required by DOE and SNL/NM requirements.

The extensive compilation of safety-related performance metrics and other ES&H program data in quarterly reports provides a feedback and improvement tool for communicating ES&H performance information to senior management and driving continuous safety improvement. On a quarterly basis, each center and division compiles ES&H performance information into a report that is rolled up into a quarterly Corporate Integrated Management Report. Incomplete data entry and limited analysis and corrective action determinations are limiting the effectiveness of this management tool. The SNL/NM center/division quarterly ES&H reports do not contain the performance information required by the ES&H Manual (e.g., most do not address the questions related to near misses, work practices, and ISM implementation and do not provide the status of corrective actions). Although both the division ES&H reports and the Corporate Integrated Management Report compile a significant amount of ES&H performance data, there is little documented evaluation of this data, conclusions regarding performance, or identification of any needed corrective/preventive actions. For example, although injury/illness metrics reflected declining performance (rating declined from green to yellow) in the report for the third quarter of 2002, the report does not adequately discuss the declining performance. Furthermore, the expectations for injury and illness performance are less than challenging. For example, the 2002 SNL/NM criteria for achieving "excellent performance" for recordable case and lost workday rates exceeded the fiscal year (FY) 2002 average rates for DOE research facilities by more than 50 percent.

Issues and Corrective Action Management. SNL/NM CPR documents for independent audits, self-assessments, occurrence reporting, nuclear safety issue reporting, conduct of operations, and quality assurance all identify some requirements for resolving and tracking corrective actions for ES&H findings identified by audits, assessments, and events. A corporate database called WebSIMS is designated in ES&H Manual Section 22A for tracking items that meet certain criteria related to severity, frequency, the difficulty of timely resolution, and radiological issues. Criterion 3 of the Corporate QA Program CPR quotes the requirements for quality improvement from DOE Order 414.1A and states generically that various officers, directors, managers, supervisors, staff members, and the workforce are required to implement the applicable QA criteria.

ES&H issues (i.e., findings, deficiencies, and problems) identified during audits and assessments, in Occurrence Reporting and Processing System (ORPS) reports, and in DOE Noncompliance Tracking System (NTS) evaluations and reports are being tracked by the various departments, centers, and divisions evaluated during the OA inspection. A new comprehensive tracking system has been developed in Center 3100 for tracking the correction of safeguards and security and ES&H issues identified as owned by Center 3100. This system includes the determination and development of recurrence controls for root causes and other essential elements of an effective issues management program. A Nonconformance Corrective Action Report (NCAR) tracking system is used for many ES&H issues identified at the Radioactive and Mixed Waste Management Facility (RMWMF). Various other databases are used in other organizations to track resolution of ES&H issues. For example, Divisions 1000 and 2000 track less significant events (events determined not to be significant enough to fall under ORPS or injury/illnesses reportability requirements) in a computerized database, and the Z Pulsed Power Accelerator (Z-Machine) Center tracks findings from annual ES&H inspections in a computerized database. Radiological protection incident reports are entered into WebSIMS for tracking corrective actions. The PAAA office maintains a database of locally tracked issues that are deemed non-reportable in the DOE NTS. Many other corrective actions for assessment findings are tracked in hard copy files by the individuals or organizations that conducted the assessment or that were responsible for actions.

Although many corrective actions for safety-related deficiencies are being identified, implemented, and tracked to closure, defined processes have not been developed or are insufficient, and implementation is inconsistent and ineffective. There is no formal institutional issues management/corrective action program or process document that details management expectations and provides management with assurance that issues are being effectively resolved and that performance data is complete and accurate. SNL/NM CPRs, guidance documents, and lower-level implementing instructions (when issued) do not provide the direction and guidance needed to define an issues management/corrective action program. Specific deficiencies in the requirements, instructions, and processes include:

- SNL/NM institutional documents do not specify requirements, parameters, or expectations for essential program elements, such as determining the extent of condition, risk, or significance; categorization for applying the graded approach; performing causal analysis; assigning or changing ownership; time frames for developing corrective actions; processes for extending action due dates; closure evidence or criteria (e.g., evidence files); action completion verification; or validation of effectiveness.

- Terminology for categorizing the results of assessments is not defined and is not used in a consistent manner across SNL/NM organizations (e.g., issues, findings, opportunities for improvement, recommendations, and observations).

- WebSIMS is not used as an effective corporate issue tracking and management tool. There are no institutional-level processes that describe the use of the WebSIMS corporate tracking system (except for the trigger criteria in ES&H Manual Section 22A for self-assessment findings). Organizations evaluated by the OA team have rarely placed any ES&H issues, except for radiological issues, into the WebSIMS tracking system. This would indicate either that the thresholds for entry into WebSIMS are too high or that line and support organizations are not adequately reviewing findings against the criteria.

- The generic procedure detailing the requirements for conducting management surveillances does not address the development of corrective actions or follow-up and closure of the identified issues.

- SNL/NM has not established a documented institutional process for addressing findings from external organizations, such as the SSO Contractor Performance Assessment Program (CPAP), SSO FR and SME findings, or Lockheed Martin corporate audits. Additionally, SNL/NM does not have a common reporting mechanism for documenting issues and associated analyses or corrective actions, such as a deficiency report or problem report. In some cases, current processes require corrective actions to be developed for deficiencies before an assessment report is issued, causing delays in issuing reports and/or insufficient time to prepare an effective set of correction actions that considers the extent and scope of problems and adequately assesses root causes and recurrence controls. In other cases, there are no specified or formal mechanisms to document and track corrective actions.

- The large number of separate formal and informal corrective action tracking entities and methods hinders effective analysis of performance and independent verification of the adequacy and timeliness of corrective actions.

As a result of the inadequacies in defining an issues management/corrective action program, many safety deficiencies and work-related incidents are not being consistently documented, thoroughly analyzed for causes and extent of condition or adverse trends, or effectively resolved to prevent recurrence. Analysis of issues identified in assessments, walkdowns, and management surveillances are not routinely documented. As discussed in the following paragraphs, deficiencies were also identified in application of reporting criteria, development of corrective actions, tracking and verification of corrective actions, application of reporting criteria, and development of recurrence controls that are based on analysis of causes and extent of conditions.

The OA team identified corrective actions for PAAA issues tracked in the NTS that were closed based on a commitment to perform an action (e.g., perform a review) rather than completion of the action. For instance, a corrective action for a 2002 NTS report (NTS-ALO-KO-SNL-NMSITE-2002-002) specified the conduct of review of the radiological control technician training and qualification process and development of a plan to address any identified deficiencies. This action item and the NTS report were closed when the review was completed. However, the review identified several deficiencies that required further corrective actions. In another instance, a February 2001 corporate QA program self-assessment issue identified deficiencies in SNL/NM personnel's understanding of their ES&H Manual responsibilities for implementing the PAAA program. The corrective action for this deficiency was to develop a formal training class available on the Web with an assigned course number. This action was closed in February 2002. While such training can be viewed from the SNL PAAA web site, the training course is still not an available course in the institutional training management system, and the ES&H Manual has not been updated to require personnel to take such a course.

Corrective actions are not always adequately documented or sufficient to prevent recurrences. A corrective action plan has not been approved for the findings from the March 2002 chemical safety audit conducted by the SNL/NM Internal Independent ES&H and Quality Audit group. The 2002 SSO CPAP report identified that numerous issues in WebSIMS dating back to 1998 have not been closed. Corrective actions do not consistently address potential or apparent work control-related inadequacies. For example, corrective actions for an event at the RWMWF in December 2001 (a fire in an electrical cabinet caused by a contractor working on energized equipment while performing unauthorized modifications) did not address questions related to extent of condition, work planning, pre-job reviews, supervision, and failure to stop work when expected conditions had changed. Injury and illness reports often do not adequately address the causes of the incidents, especially when work control issues are involved. Further, the recommended and/or implemented corrective actions are documented by SMEs from Center 3100, although the responsibility for implementation of the actions typically rests with line management. There is no mechanism for tracking or documenting the actual actions taken.

In a review of a sample of documented incidents and accidents, the OA inspection team identified several instances where causal analysis was insufficient and less-than-conservative ORPS screening was performed. For example, the December 2001 fire in the electrical cabinet at the RWMWF was not reported, although it involved unsafe work practices that resulted in a fire, activation of fire and smoke alarms, shutdown of essential ventilation systems, evacuation of the facility, and damage to panel equipment. The RMWMF NCAR did not identify, evaluate, or ensure corrective actions for the work control aspects of this event since an FMOC employee performed the work. FMOC did not conduct any formal evaluation of the work control aspects of this event or institute any actions to prevent recurrence. In addition, there were a number of instances in the past year where safety requirements were not adequately implemented, resulting in electrical shocks to workers exceeding 50 volts, an SNL ORPS reporting criteria, but the events were not reported through ORPS. Further, causal analysis of the work control issues was insufficiently documented on the injury/illness reports. In addition, incidents observed by the OA team resulting in temporary work stoppages to address potential safety concerns related to excavations, fall protection, and exposure to flammable and toxic material were not conservatively evaluated for ORPS reportability with respect to criterion 3 of the SNL/NM and DOE reporting criteria. Process weaknesses may be contributing to the insufficient formality in documenting evaluations and less than conservative reporting decisions. SNL/NM has not established guidance or criteria for the determination of a near-miss categorization for reporting into the ORPS. In addition, there is no documented SNL/NM process for conducting investigations of injuries and illnesses and reporting to Computerized Accident/Incident Reporting System (CAIRS) when required.

Deficiencies in the management of safety issues were also reflected in insufficient corrective and preventive actions to address incidents involving lockout/tagout at SNL/NM. Lockout/tagout program and performance deficiencies were identified in 2002 by a program self-assessment and a Lockheed Martin external audit. No corrective action plan was developed for the program self-assessment findings because the responsible SNL/NM individuals incorrectly determined that the corrective actions for the corporate audit adequately addressed the issues. However, several of the findings in the self-assessment were not addressed by the audit corrective action plan. Subsequently, the OA team identified several systemic performance deficiencies related to lockout/tagout that resulted in SNL/NM stopping all lockout/tagout work and issuing an ORPS report. (See Appendix E.)

Systemic deficiencies in SNL/NM issues and corrective action management processes were identified in a number of internal and external audits, assessments, and special reviews in the past several years. While standing safety committees, such as the LIWG and the Quality Assurance Working Group, have worked to address deficiencies in issues management, SNL/NM has made limited progress. Root causes and causal factors have not been identified, and corrective actions have been improperly and prematurely closed. An NTS report (NTS-KO-SNL-NMSITE-2000-0001) identified the lack of a comprehensive QA plan at SNL/NM, and subsequent QA program self-assessments in 2001 identified continuing potential noncompliances in process improvement/corrective action/issues management and management assessments. The corrective actions for these QA issues were reported as completed in December 2001. Elements of the same problems were subsequently identified in an external governance initiative panel report conducted in April 2002, the Lockheed Martin Corporate audit in June 2002, a QA assessment of the corporate corrective action process in November 2002, and this OA inspection. With the exception of the corporate audit, no specific action plans were developed for the issues raised by these reviews and assessments, and the corrective actions for the corporate audit were focused only on the ES&H functional area assessments and corrective action tracking conducted by Center 3100. A November 2002 formal review of the corporate corrective action process determined that the management assessment program implementation had been stopped awaiting management action, and that numerous quality issues may have been prematurely closed or not fully effective. Although some limited corrective actions have been taken, SNL/NM has not effectively addressed the recognized and longstanding weaknesses in the issues management and corrective action programs.

As discussed in Volume II of this inspection report, there are also weaknesses in SNL/NM processes and performance for management of issues and corrective actions related to the emergency management program.

Finding #4: SNL/NM issue management processes and implementation are insufficient to ensure consistently appropriate and timely identification, documentation, evaluation, resolution, and recurrence control for deficiencies in ES&H and emergency management programs.

Lessons Learned. Externally generated lessons learned are being screened for applicability to the SNL/NM by a site lessons learned coordinator and line ES&H coordinators; lessons-learned reports are being generated from SNL/NM events; and both external and internal lessons learned are being disseminated to workers. Lessons learned are discussed at ES&H staff meetings, LIWG meetings, other ES&H safety committee meetings, and employee safety meetings. Some lessons learned are sent to employees by electronic mail and are included in site publications. Employees also subscribe to a lessons-learned distribution system. Selected internally and externally generated lessons learned are binned into 23 functional areas on an institutional web site accessible to potential users at SNL/NM, and each division and various ES&H committees also maintain lessons-learned web sites.

Notwithstanding the communication of many lessons learned at SNL/NM, there are several weaknesses that are limiting the effectiveness of the lessons-learned program. The institutional program requirements document (the ES&H Manual) does not provide sufficient requirements or expectations to describe the processes and ensure consistent and effective implementation of the lessons-learned program. The ES&H Manual does not address use of SMEs for evaluation of applicability or needed actions and does not reference any responsibilities of the program owner for such institutional actions as the maintenance of the institutional web site, screening external lessons learned, or processing SNL/NM lessons learned for dissemination to the DOE complex. Additionally, the ES&H Manual does not address some potentially necessary actions (e.g., assessments, hardware inspections, or procedure/process changes). For example, the CY 2002 ES&H self-assessment at Z-Machine identified that a number of foreign-made shackles and hooks of unknown quality were being used in several areas of the facility; an excellent lessons learned was developed but there was no directed action, either at the Z-Machine or for other SNL/NM facilities, to search for and remove other suspect shackles and hooks or other improper lifting equipment. Few external lessons learned and not all lessons learned from internal SNL/NM events are being placed in the binned topical categories on the institutional web site. For example, there was at least one wall penetration event reported in ORPS in 2001, but no lessons learned are posted in that category, and excavation events reported in ORPS were not binned in the excavation category.

SNL/NM has a defined process for responding to some DOE or SNL/NM issues (i.e., those categorized as critical events). However, with some exceptions, line organizations have not developed implementation instructions to detail their processes for implementing the lessons-learned program. Formal documentation of any actions taken in response to non-urgent lessons learned (e.g., inspections, placement in required reading, or discussion at safety meetings) is not maintained, although electronic mail records indicate that many lessons learned are being disseminated. Procedures for work planning and training do not specifically require the research of lessons learned in the development of work documents or training plans. Formal post-job briefings are not addressed in work control procedures and are not typically employed as a method to obtain lessons-learned feedback from SNL/NM workers.

Employee Concerns Programs. Processes for handling employee concerns appear to be effective. SNL/NM employees and subcontractors have access to several employee concerns programs that register safety questions or concerns and obtain feedback and resolution, and allow for confidentiality or

anonymity. Concerns are being resolved informally at the workplace level. Therefore, few concerns are formally documented and processed through the employee concerns programs. The formal employee concerns program that implements DOE Order 442.1 received only three ES&H-related concerns in the last two years. The SNL/NM Ethics and Business Conduct Office also processes one or two ES&H-related concerns each year. The availability of this process and the DOE Employee Concern Office is advertised to SNL/NM employees in an annual ethics training course and Code of Ethics booklet handout.

D.3 CONCLUSIONS

SSO has a functional FR program and has recently performed a number of major self-assessments. SSO line management oversight processes need additional attention to ensure that expectations for line management oversight responsibilities are clearly defined and effectively implemented. The expectations for assessment programs are not well defined, and established assessment schedules are not being met. Issues management and corrective action management processes are not well defined and coordinated. Through recent self-assessments, SSO has developed a better understanding of its current weaknesses and has developed approaches for taking corrective actions. However, SSO's progress toward the needed improvements has been limited.

SNL/NM uses many mechanisms to provide feedback and improvement in safety performance. Requirements have been established for conducting independent and management assessments, documenting deficiencies and tracking corrective actions, addressing employee concerns, and identifying and communicating lessons learned. Many assessments and inspections are performed, corrective actions are taken to address assessment findings, and lessons learned are developed and communicated to workers.

However, there are continuing process and implementation weaknesses that have hindered the effectiveness of these mechanisms in driving consistent, continuous improvement, especially in reporting and managing the evaluation and resolution of safety deficiencies. Management assessment programs do not adequately define processes that provide clear expectations and that ensure that effective safety assessments are being scheduled and performed and that assessments focus on ISM elements and observing work activities. The processes and performance for managing ES&H incidents and deficiencies do not ensure that issues are properly documented, investigated, and reported; adverse trends and repetitive incidents are identified; the extent of condition, causes, and recurrence controls are properly established; and implementation of actions is timely and effective. Further, management has not always ensured that corrective actions for deficiencies issues are coordinated, with milestones, clear acceptance criteria, and timely monitoring for completion and verifying effectiveness. SNL/NM processes for lessons-learned applicability lack sufficient rigor to provide assurance that important lessons are consistently and effectively acted upon and that task level feedback is solicited from workers.

D.4 RATING

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

D.5 OPPORTUNITIES FOR IMPROVEMENT

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

SSO

1. **Enhance the performance of line management oversight activities by developing and/or enhancing SSO plans and procedures.** Specific actions to consider include:

   - Enhance the ES&H plan to include a re-evaluation of the ES&H assessment schedule that reflects SSO priorities for line management oversight activities and a realistic assessment of capabilities of current staffing.

   - Accelerate efforts to develop, issue, and implement a set of procedures that complement the ES&H management plan. Ensure that procedures delineate responsibilities and provide sufficient detail to ensure consistent and effective implementation of expectations.

   - Define the entire process for implementation of the performance evaluation process to include detailed ES&H criteria, clear communications of criteria, and roles and responsibilities of various SSO organizations and individual positions.

   - Ensure the rigor and effectiveness of SSO FR and SME assessment and operational awareness activities by establishing expectations for observing work activities and operations.

   - Conduct work planning and control assessments on a routine basis. Involve SMEs on a rotating basis for such disciplines as radiation protection and industrial hygiene and safety based on the hazards of the operations and work activities being reviewed.

   - Require formal SSO involvement, participation, and concurrence in decision-making that may limit ISM effectiveness, such as exemptions to ES&H Manual requirements.

   - Revise the program documents and procedures to reflect the transition of responsibilities and functions from the former Albuquerque Operations Office to SSO.

   - Ensure that affected SSO personnel understand the expectations and new procedures, and include training as necessary.

   - Monitor implementation of newly issued procedures to ensure that expectations are understood and implemented. Hold individuals and organizations accountable for meeting established requirements.

2. **Develop office-wide policy and implementing procedures that address the essential elements of an effective corrective action/issues management program.** Specific actions to consider include:

   - Ensure that the following items are addressed: reporting vehicles and tracking tools (including a general deficiency or problem report); a process for determination of risk/significance/priority (application of a graded approach), determination of extent of condition, and causal analysis (applied to all items, but with rigor based on a graded approach; include root and contributing causes); consideration of reporting in accordance with PAAA or ORPS; assignment/reassignment of ownership; expectations for developing corrective actions that prevent recurrence; corrective action plan and closure approval requirements (supervisory review); time frames for executing process steps and for extending due dates, closure, and verification (on a graded approach and/or sampling basis); and effectiveness reviews for significant issues, trending, and analysis of issues.

- Ensure that SSO corrective action management systems are coordinated with SNL/NM issues management systems, where appropriate, to ensure consistency and eliminate unnecessary redundancy.

- Update the KIMS user manual and develop procedures that define expectations for its use that will ensure consistency.

- Crosswalk the results of the March 2002 NNSA SSO review, recent self-assessments, results of this OA inspection, and other relevant assessments.

- Based on the crosswalk, develop an integrated comprehensive improvement plan that appropriately prioritizes and assigns resources and outlines realistic schedules to improve SSO operations and that is integrated with the actions to address NNSA reengineering efforts.

- Develop a mechanism for routinely updating management on the status of actions relevant to the comprehensive improvement plan.

- Develop mechanisms for change control and for regular updates to the comprehensive improvement plan.

- Use the comprehensive improvement plan as a management tool and ensure the provisions of the plan are implemented effectively.

SNL/NM

1. **Formally define clear institutional expectations and implement processes for feedback and improvement programs to provide assurance that ISM processes and performance are effectively evaluated and that weaknesses are identified and corrected.** Specific actions to consider include:

    - Clarify and establish at an institutional level the ownership of independent and management assessment, and issues and corrective actions management programs and ensure the programs are effectively implemented.

    - Consolidate, integrate, or provide clear linkage between the institutional requirements for these programs that are contained in various requirements and guidance documents. Revise and update the ES&H feedback and improvement program document to address self-assessment and corrective actions.

    - Develop processes that define an appropriate minimum set of requirements and the parameters for implementing these programs versus the current listing of high-level requirements and guidance tools. Build on the new model developed in Center 3100 for functional area self-assessments and corrective action tracking.

    - Consolidate the process and requirements for the Center 3100 functional area assessment program from the annual plan into a single program plan or procedure. Provide appropriate authorities and mechanisms in the Center 3100 process for documenting and ensuring proper evaluation and resolution of line performance or program implementation issues.

- Ensure that independent and management/self-assessments of ES&H routinely and specifically address all elements of ISM, including such crosscutting topics as assessment, corrective action, lessons learned, training, and work control. Ensure that ES&H assessments have a routine focus on observation of work activities.

- Implement a monitoring process to ensure the adequacy of management assessment schedules and completed assessments until all organizations are consistently achieving management expectations.

- Establish clear expectations for the documentation and investigation of work-related incidents with safety implications, such as the recent excavation events, by clarifying the thresholds for conducting operations event critiques and ORPS reporting.

- Provide training and mentoring to the divisions/centers/departments in the planning, conduct, and documentation of assessments.

2. **Provide mentoring for team leaders, supervisors, and worker on how to watch work and effectively perform job observations to ensure that deficiencies are recognized, documented, and corrected.** Specific actions to consider include:

   - Consider expanding the behavior-based safety program to resemble those that have improved safety at other DOE sites.

   - Have knowledgeable managers and ES&H personnel accompany team leaders and supervisors during job observations to increase experience in observing work and identify deficiencies.

3. **Ensure that the essential elements of an effective corrective action/issues management program are formally established and implemented (documented).** Specific actions to consider include:

   - Ensure that the following items are addressed: reporting vehicles and tracking tools (including a general deficiency or problem report); a process for determination of risk/significance/priority (application of a graded approach), determination of extent of condition, and causal analysis (applied to all items, but with rigor based on a graded approach; include root and contributing causes); consideration of reporting in accordance with PAAA or ORPS; assignment/reassignment of ownership; expectations for developing corrective actions that prevent recurrence; corrective action plan and closure approval requirements (supervisory review); time frames for executing process steps and for extending due dates, closure, and verification (on a graded approach and/or sampling basis); and effectiveness reviews for significant issues, trending, and analysis of issues.

   - Rework the WebSIMS tracking tool or incorporate it into a more inclusive institutional issues management/corrective actions tracking system to provide a "user friendly," practical tool for management of issues.

   - Develop mechanisms for routinely communicating the status of corrective actions to management.

4. **Strengthen processes for industrial hygiene investigation reports, evaluating injury and illness reporting, PAAA deficiency tracking, and screening of events for ORPS reporting.** Specific actions to consider include:

- Establish clear requirements for the documentation, tracking, and assurance of implementation of recommended actions on industrial hygiene investigation reports or an agreed-upon justification when recommendations are not implemented.

- Issue a procedure for conducting and documenting injury/illness investigations and reporting to the DOE CAIRS.

- Integrate and apply the issues management/corrective action elements cited above to the evaluation and resolution of injury incidents.

- When developing the improved corrective action/issues management program and the injury/illness reporting evaluation process, ensure that they include steps for evaluating and reporting issues through PAAA and ORPS as required.

- Ensure that responsible line managers and staff are appropriately formally trained in the requirements and processes for compliance with the PAAA rule.

- Formally integrate PAAA review mechanisms into the improved corrective action/issues management processes to provide assurance that all identified safety deficiencies are reviewed against PAAA criteria.

5. **Establish and implement clear institutional expectations and processes that provide assurance that lessons learned are reviewed and applied and that feedback is formally solicited from workers.** Specific actions to consider include:

   - Revise institutional documents (not just web sites) to clearly delineate the roles, responsibilities, and authorities of the program owner.

   - Revise institutional documents (not just web sites) to clearly define the process for reviewing and implementing lessons learned, the roles and responsibilities of evaluators and potential users, and the process for generating lessons learned for dissemination to other SNL/NM organizations or the DOE complex.

   - Incorporate into institutional documents a structured and documented process for lessons-learned applicability reviews by SMEs and line organizations that ensures that any necessary actions are identified, documented, and implemented.

   - Incorporate into institutional documents and procedures for training plan development and work planning explicit expectations that lessons learned are to be reviewed and applied to these activities. Include provisions for management to ensure that applicability and action feedback reviews are consistently performed and documented by support and line organizations.

   - Establish processes for formal documentation and dispositioning of post-job reviews for work packages and project activities to promote direct worker feedback and procedure improvement.

   - Expand the number of external lessons learned published to the topical area links on the lessons-learned web site to provide a broader base of information on problems and good practices encountered throughout the DOE complex.

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 (ISM) at Sandia National Laboratories – New Mexico (SNL/NM) focused on safety performance during conduct of programmatic work, construction and facility maintenance, and waste management activities.

For programmatic work, OA reviewed the application of the core functions at facilities from two different centers: the Z Pulsed Power Accelerator (Z-Machine) and the Advanced Manufacturing and Processes Laboratory (AMPL). At Z-Machine, observed work activities included facility preparations and readiness verifications for several machine "shots" as well as programmatic maintenance activities. At AMPL, typical programmatic work was observed in four of the six AMPL departments.

For construction and maintenance activities, the OA team evaluated work in the areas of facility maintenance, construction, and service contractor work. SNL/NM's Facilities Management and Operations Center (FMOC) provides support to line organizations and manages the site infrastructure, including project and facility maintenance. Most construction work is performed by SNL/NM contractors and subcontractors and is governed by construction contracts. Service contractors typically perform roof maintenance, repair of water mains, supply of chemicals and gases, roadwork, and other site support services according to service contract provisions. Observed work activities included construction, corrective maintenance, preventive maintenance, testing, lockout/tagout, confined space, fall protection, excavation, and service work on cranes.

For the waste management portion of the inspection, OA reviewed sitewide pollution prevention activities and waste management activities at line organization generator facilities and SNL/NM waste management facilities that store and/or process waste materials for disposition. Generator facilities were reviewed at both AMPL and Z-Machine, while site waste management operations were reviewed at the Radioactive and Mixed Waste Management Facility (RMWMF), Hazardous Waste Management Facility (HWMF), and Solid Waste Treatment Facility (SWTF). The review of the first four core functions of ISM focused on waste operations activities performed at the RMWMF, including waste sorting, sampling, and treatment.

For all three types of work observed (programmatic, construction/maintenance, and waste management), the implementation of institutional, facility-level, and activity-level work control processes was examined. Environment, safety, and health (ES&H) programs, procedures, and policies, such as stop-work policies, were evaluated, and hazards analysis and control systems were examined. This approach enabled OA to evaluate the implementation of work control processes governing a broad spectrum of work in the areas of programmatic work, maintenance, and waste management.

OA also reviewed selected aspects of SNL/NM's efforts to implement the requirements of 10 CFR 830, Subpart B, which establishes requirements and milestones for completion of authorization basis documents. As part of this effort, OA reviewed various products developed as part of the authorization basis effort, including safety evaluation reports (SERs) for the Annual Core Research Reactor and the Gamma Irradiation Facility; updates to SERs; various draft documented safety analyses (DSAs) and

technical safety requirements (TSRs); all unreviewed safety question (USQ) packages, including screens, determinations, and evaluations prepared under the current USQ procedure; and Sandia Site Office (SSO) evaluations of SNL/NM submittals. OA also reviewed selected procedures and guidance documents used to develop these products, and staffing and qualifications of SNL/NM and SSO personnel involved in the 10 CFR 830, Subpart B efforts. The results of this review are relevant to SNL/NM hazards analysis processes and are discussed under Core Function #2.

E.2 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.

The corporate work process, Corporate Process Requirement (CPR) 001.3.4, is referenced in the SNL/NM ISM system description and ES&H Manual and establishes expectations for the development of program or project plans that identify, prioritize, and schedule tasks to be performed, milestones to be accomplished, resources required, deliverables, and the eventual close-out of the work. The planning conducted in support of this requirement is expected to identify goals and objectives that are specific, measurable, achievable, challenging, and relevant to the organization's overall missions.

The SNL/NM institutional requirements delineated in the corporate work process outline the general management expectations applicable to Core Function #1. However, SNL/NM ISM program and implementing guidance does not further address institutional expectations for defining the scope of work at the activity and task levels, which may contribute, in part, to deficiencies in work definition for some categories of work reviewed (see below).

The scope of programmatic work activities at Z-Machine and AMPL was generally well defined. At AMPL, programmatic work can be either long-term research and development projects (e.g., lead zirconate titanate [PZT] formulation in the Ceramics and Glass Department), or short-term prototype development work in support of SNL/NM research projects, such as the AMPL Electronics and Organics laboratories. War Reserve Production work at AMPL, in particular, is well defined in such technical work documents as safe operating procedures and work instructions. Customer support work is adequately defined in service work orders, customer-supplied specifications and drawings, and through informal interactions. Personnel and equipment resources (e.g., local ventilation and laboratory hoods) for conducting research and customer support work at AMPL is sufficient to perform most work safely. Work processes at AMPL, although sometimes informal and not sufficiently documented (see Core Functions #2 and #3), involve line management, workers, safety and industrial hygiene personnel, and the customer in defining the work activity and the conditions in which the activity is to be performed.

The scope of facility-level work at Z-Machine is extensively described in the safety analysis document for Z-Machine. At the activity level, the work is generally well defined in such technical work documents as procedures, work instructions, and permits. The scope of work for major work evolutions or new experiments involving Z-Machine is adequately documented as the initial condition in the experimental review process.

Construction and service contractor work is also well defined through the use of contracts, terms and conditions, project and milestone schedules, building and service specifications, and direction by SNL/NM contract representatives. Building plans, specifications, and direct supervision provide day-to-day work definition for construction and service contractor work. Frequent production, scheduling, and

safety meetings address safety, work breakdown, scheduling, coordination of subcontractors, and allocation of resources.

For maintenance and service contractor work, procedures are appropriately used to prioritize work based on risk, mission, and the importance of systems and equipments being serviced. The Maximo work order system is effectively used for direction and accountability for service contractors on individual service tasks. For example, service contractors cannot perform work or charge time without authorization by a Maximo work request and direction from FMOC. Similarly, maintenance personnel must have a Maximo work request approved through planning and supervision to perform any work. Allocation of maintenance and service contractor resources is based on work order priorities. On lower-risk jobs, the priorities are based on the importance of the systems/equipment and the customer's need.

Although work for complex and higher-risk maintenance jobs was well defined, Maximo work orders and job plans for many troubleshooting and routine corrective maintenance work orders did not fully or adequately define the scope of work. There is extensive reliance on skill-of-the-craft to determine work scope rather than documenting work scopes on work orders. For example, the limitations on "troubleshooting" and "repair and replace" work orders were not always specified or documented. Some work requests were issued to the craft with the problem statement called in by the customer as the statement of work, rather than a clearly described scope of work determined through work planning, customer interaction, or walkdowns. As such, work definitions were not always adequate to allow identification of all job hazards. For example, the work request for the Building 851 crane rail work did not have reference drawings or depict the configuration or bolting specification for the support columns. Work requests to replace controllers for the Building 878 chill water pumps lacked specificity for building variable frequency drive racks, mounting the drives, running conduit, and the outage necessary to tie in to the motor control center. Work requests for some routine maintenance work were vague, including statements such as "too hot," "too cold," "assist with crane installation," and other statements that did not fully define the work to be performed. Similar deficiencies with work definition for routine maintenance were identified during the 1997 Independent Oversight evaluation of safety management at SNL/NM.

In the waste management area, the scope of work was generally clearly defined and effective. The Radioactive Waste/Nuclear Material Disposition Department (RWNMDD) has implemented a formal Waste Management Program (PRG 95-01) that defines program goals and objectives, processes, organization, and interfaces, including functional roles and responsibilities, and the facilities, programs, and procedures for radioactive and mixed waste. This document provides an effective framework for achieving the stated goals of management and disposal of waste in accordance with applicable requirements. In fiscal year (FY) 2002, SNL/NM established a goal to send the majority of centrally managed legacy radioactive and mixed waste to offsite disposal by the end of FY 2004 and has made significant progress toward achieving this goal.

In order to meet the defined waste management plan and program goals, SNL/NM issued a subcontract to a waste management subcontractor, which defines the overall scope of work to be performed, including operation of the RMWMF and management of a number of radioactive waste storage facilities. SNL/NM provides direction and control, day-to-day line monitoring, guidance, and safety and health support to the waste management subcontractor. At the facility level, a variety of formal mechanisms are used to provide direction and set expectations for work, including routine plan-of-the-day, plan-of-the–week, and project leader meetings. At the activity level, field operating procedures adequately detail the scope and bounds of individual project activities and are supported by task-specific work plans and pre-job briefings that further clarify and define work to be performed.

Summary. The scope of work for most activities reviewed was generally well defined through institutional programs and plans and various subordinate mechanisms that translate missions into manageable activities and tasks. These mechanisms include contract specifications, terms and conditions, project and milestone schedules, technical work documents, safety analysis documents, and related documents. Formal planning meetings conducted daily and weekly are also used in some line organizations to effectively prioritize individual activities and set expectations. Although work scope was generally well defined for most activities reviewed, work definitions for some categories of work, including troubleshooting and some routine corrective maintenance, were insufficient to identify hazards and appropriate controls. A lack of specific guidance and direction for the definition of work scope at the activity level is evident in the site's ISM and ES&H Manual and line organization implementing procedures, which may contribute to the observed weaknesses in some categories of work.

E.2.2 Core Function #2 – Analyze the Hazards

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

Institutional and Facility-Level Hazards Analyses. The SNL ES&H Manual delineates a process to identify and analyze hazards associated with the performance of project activities and operation of facilities. Each activity is subject to a primary hazard screening (PHS) to identify and provide a preliminary review of the associated hazards. The PHS is also used to determine the appropriate rigor for further hazards analysis and facility authorization levels based on the highest hazard categorization for a facility. This process provides a sufficient framework to develop adequate bounding safety envelopes for non-nuclear and nuclear site activities and facilities when properly implemented as described in the ES&H Manual.

The PHS system is a computer-based system that uses an extensive question set to initially determine hazards, controls, and hazard classifications for activities. The process also determines whether further hazards analysis is required and determines the level of readiness review for starting the activity. Primary hazard reviewers from the program organization are responsible for completing a PHS for an activity. This approach is an effective method for developing bounding safety envelopes and determining whether further reviews are required. However, deficiencies were evident in the question set logic for determining the appropriate hazard classification of non-nuclear activities, operations, and facilities.

The ES&H Manual defines hazard categories in terms of standard industrial hazards and low, medium, and high non-nuclear hazards using an approach based on the nuclear hazard classification model. The definitions are based on consideration of unmitigated hazards to determine the appropriate hazard classification. Consideration of unmitigated hazards is required by the ES&H Manual and is necessary to ensure that the appropriate level of rigor is applied to the analysis of the hazard, identification of controls, and level of readiness review and approval. However, non-conservative assumptions embedded in the PHS question set have the potential to result in incorrect and non-conservative results for many facility/activity hazard classification scenarios. For example, the ES&H Manual defines risk group 4 biological agents as agents that are likely to cause serious or lethal human disease for which preventive or therapeutic interventions are not available. It further states that these agents have high individual and community risk. However, using the current question set, a hypothetical activity involving a risk group 4 biological agent would result in a PHS activity level classification of "Low," defined by the ES&H Manual as having negligible onsite and offsite effects. Although the question set would provide a warning that further evaluation and risk assessment by industrial hygiene is required, this activity hazard classification would only require a SNL/NM hazards assessment and low-hazard readiness review. It would not require a SNL/NM safety assessment, a SNL/NM readiness assessment, or any involvement by DOE in the safety review or activity authorization process as required by the ES&H Manual for higher activity hazard classifications.

Other non-conservative assumptions that could result in an inadequate level of hazard review were evident. For example, the ES&H Manual does not require a hazards assessment for activities with a hazard classification of "standard industrial hazard." The ES&H Manual definition of the "standard industrial hazard" states in part that this classification will only be used for hazards that can only affect the workers involved in a specific activity. However, questions in the question set default to this classification in several cases for consideration of mitigated hazards. Consequently, some hazards potentially affecting co-located workers involved in other nearby activities might not be sufficiently analyzed, as required by a hazard classification of "low."

Although not required by the PHS process, the individual programs or departments, in some cases, conservatively perform higher levels of hazard review. For example, Z-Machine is considered a low-hazard non-nuclear facility by the PHS process and consequently is only required to perform hazards analysis beyond the PHS. However, the SNL/NM Pulsed Power Sciences Center and SSO have agreed that the facility will maintain a more comprehensive safety assessment document (equivalent to those required by DOE Order 420.2A, *Safety of Accelerator Facilities*). While appropriate, this action illustrates the non-conservatism in the PHS system.

Finding #5. Incorrect assumptions in the SNL/NM primary hazard screening process have resulted in non-conservative facility/activity hazard classifications; consequently, the appropriate level of hazards analysis, review, and approval is not always performed.

In the area of chemical exposures, SNL/NM Industrial Hygiene performs periodic surveys of work areas and conducts exposure monitoring based on potential worker health risks. For example, at AMPL, higher-risk laboratory and production areas, such as the PZT and Microelectronics Development Laboratory (MDL) laboratories, are routinely surveyed and monitored. Exposure monitoring, when conducted, is documented in Industrial Hygiene investigation reports. However, for a number of surveys conducted by Industrial Hygiene in support of new or ongoing work, there is no record of the evaluation conducted, the potential risks of the activity, or the basis for conducting or not performing periodic re-surveys or exposure monitoring. For example, welding activities at Z-Machine have not been evaluated for welding fumes since 1999, and the routine use of hexane in permitted confined spaces has never been analyzed. (See Core Function #4, Finding #9.)

10 CFR 830, Subpart B, Process and Implementation. SSO and SNL/NM management are devoting significant attention and resources to implementing the 10 CFR 830, Subpart B, requirements. SSO and SNL/NM have allocated sufficient staff and resources to provide for timely development and review of authorization basis packages. To meet their expectations, SSO has had to draw on resources from other organizations. The SNL/NM personnel have good qualifications and experience commensurate with their responsibilities. SSO has provided clear expectations in a formal procedure and checklist for the development of authorization basis packages and is implementing a rigorous review process.

SSO and SNL/NM have made significant progress toward developing the requisite authorization basis documents. SNL/NM has submitted authorization basis packages to SSO for four of five affected operating nuclear facilities for review and approval in accordance with the schedule, and is on schedule to submit the authorization basis package for the fifth operating facility and another applicable facility (which is currently not operating). The SSO reviews have resulted in approval of three of the packages—the Annular Core Research Reactor (ACRR), Gamma Irradiation Facility (GIF), and Manzano Waste Storage Facilities—and issuance of a conditional SER for onsite transportation. OA's review of selected (ACRR and GIF) SSO SERs focused on how SSO reviewed the characterization of hazards and releases, control strategies, and systems, structures, and components; no significant concerns with the SSO review

process were identified. However, SSO and SNL/NM have not reached agreement about the need for revisions to the conditionally approved onsite transportation authorization basis package.

OA's review of the ACRR and GIF DSAs, TSRs, and annual updates focused on the characterization of hazards and releases, control strategies, and safety-significant structures, systems, and components. OA did not identify any significant errors or omissions. However, a few aspects of the SNL/NM draft authorization basis procedures warrant additional attention. The working drafts of the DSA and the TSR procedures lack training and qualification requirements, and thus do not fully meet criterion 2 of the SNL Corporate Quality Assurance Program. The SNL/NM Nuclear Facilities Safety Committee does not independently review USQs, which is contrary to the responsibilities section of the Committee's charter. Also, the SNL/NM corporate authorization basis organization (3111) is responsible for independently reviewing all aspects of DSAs and TSRs; in some cases, appropriate reviews were conducted, but in one case reviewed by OA, the SNL/NM 3111 organization review was limited to the programmatic aspects and did not focus on technical aspects.

There are deficiencies in two aspects of the USQ process at SNL/NM: (1) the new USQ procedure contains errors that could lead to non-conservative USQ dispositions, and (2) SNL/NM's implementation of the USQ process does not meet established requirements in several cases.

The new USQ procedure approved by DOE was issued in September 2002 to implement the requirements of 10 CFR 830.203 and was extensively reviewed within SNL/NM and by SSO and DOE Headquarters. However, the USQ procedure has several logic errors that, if followed verbatim, could lead to non-conservative USQ disposition. For example, in at least three situations, the USQ could be incorrectly pre-screened because the process defined in Attachment B of the USQ procedure does not address credible situations (e.g., an item that should be described in the safety basis but was omitted). Similar situations exist in at least three cases for the "Potentially Inadequate Safety Analysis" (PISA) process defined in Attachment E of the USQ procedure. These procedural deficiencies have not resulted in incorrect determinations to date; however, SNL/NM personnel recognize that these deficiencies could result in non-conservative USQs and plan to correct the deficiencies in the USQ procedure.

OA's review of all 14 USQs performed under the new procedure indicates continuing deficiencies in SNL/NM's implementation of the USQ process. Of the 14 USQs, 12 did not have sufficient information to independently confirm the conclusions. In two cases, the USQ package did not fully comply with the SNL/NM procedural requirements. In one of these cases, the USQ did not contain the required activity description. The other case resulted in a situation where a correct USQ determination was made (a positive USQ) but the PISA process was not entered into as required by the SNL/NM procedure and 10 CFR 830 requirements. In this instance, SNL/NM discovered that components that were described in the addendum to the Sandia Pulsed Reactor Facility safety analysis report for the Burnup Credit Critical Experiment were not actually installed. SNL/NM personnel determined that the discrepancy was not a PISA because the components were only discussed in the system description and did not affect the analysis section, and SSO concurred with this decision. However, this interpretation is not consistent with the requirements of 10 CFR 830.203, paragraphs (d)4 and (g) and DOE Guide 424.1-1, which specifically state that discrepancies should not be screened out if they are identified anywhere in the safety basis. Further, because the PISA was not entered into, there is no positive assurance that the discrepancy between the as-found condition and the system description would be corrected.

Finding #6. The SNL/NM unreviewed safety question (USQ) procedure contains errors that could lead to non-conservative decisions, and the USQ process has not been properly implemented in all cases, resulting in USQ packages that do not include all of the required information and analysis.

The SNL/NM deficiencies in USQ implementation are a recurring problem. SSO's 2002 annual appraisal of SNL/NM identified similar deficiencies, including examples of two potentially inadequate PISA evaluations (out of 75 USQs). Although SNL/NM developed a new procedure (approved by the National Nuclear Security Administration) and provided training, deficiencies in the USQ processes and implementation persist, as evidenced by the deficiencies in most of the recently completed USQs.

Activity-Level Hazards Analysis. Although the ES&H Manual provides a sufficient framework to develop an adequate bounding safety envelope for facilities and some activities, the ES&H Manual and the SNL/NM ISM program do not adequately address the requirements and direction necessary to ensure that documented systems for the identification and analysis of many activity-specific hazards are implemented at the working level. Consequently, some PHSs do not facilitate identifying the specific hazards and corresponding controls for activity-level work and are not linked to technical work documents for all types of work. The PHS system is the primary hazard identification and analysis tool at SNL/NM; lower-level systems for identifying hazards at activity-level work are not defined.

Because the institutional guidance provides only high-level direction, SNL/NM program organizations have established various processes and procedures for identifying and analyzing the hazards for specific work activities. Some systems, such as those at Z-Machine, are comprehensive and effectively identify hazards for most activities. The Pulsed Power Safety Committee safety approval form process analyzes hazards associated with Z-Machine experiments, tests, and experimental work activities. This process includes a formal, comprehensive hazards checklist. Further reviews and approvals are triggered by the results of the checklist process, with additional reviews by the Z-Machine Safety Committee, as necessary; the most serious hazards and proposed controls require review and approval by the Pulsed Power Safety Committee. Z-Machine hazards associated with routine maintenance and operational activities are well analyzed through the Z-Machine procedure review and approval process.

Although Z-Machine's activity review process is comprehensive, some non-routine jobs performed by Z-Machine workers involving potential hazards fall below the threshold for using the safety approval form process. The safety approval form process addresses only experiment-related work, and does not cover non-routine maintenance and modifications to the facility performed outside established facility procedures. For example, a potential lead paint hazard was not recognized or analyzed prior to performing work on an equipment rack. The safety approval form process was not applicable to the work because the work was not related to a particular experiment. The Z-Machine Safety Committee charter states that the committee will meet to review the installation of significant new equipment and machine configuration changes that could affect the ES&H of personnel; however, use of the safety approval form is not required.

At AMPL, the process for identifying, analyzing, and documenting activity-level hazards is not sufficient. Some activity-levels hazards are identified and documented through the PHS process or through technical work documents. The PHS process, for example, is generally effective in identifying mechanical, thermal, and electrical hazards, but is less effective at identifying hazards for chemicals. In some cases, technical work documents at AMPL have been effective in identifying and describing activity-level hazards. For example, the description of the lead hazard is documented in the ES&H operating procedure for PZT processing. However, in other AMPL work activities, a number of hazards are not sufficiently identified, analyzed, or documented through either the PHS or a technical work document. For example, the AMPL Organics Department routinely uses a variety of epoxies and chlorinated solvents, including some carcinogens. Although the PHS for this department identifies these materials, there is no description of the hazards posed to workers in the PHS and no identification of specific controls for the hazards. Similarly, the use of service work orders and other technical work documents for this department (e.g., ES&H standard operating procedures) have been insufficient to identify, document, and communicate the specific hazards. Although a material safety data sheet (MSDS) may be used to

communicate the hazards to workers, the health hazards and controls in the MSDS are not tailored to the work activity. Informally, many activity-level hazards are identified and discussed among workers, customers, and members of the ES&H team. However, management expectations for conducting the activity-level hazard identification and analysis process at AMPL has not been documented or communicated to workers. Consequently, the most likely hazards and appropriate hazard controls for a specific activity hazard cannot be identified in all cases. (See Core Function #3.)

For SNL/NM maintenance activities, several job-site hazard evaluations (JSHEs) performed by maintenance and the ES&H organization for higher-risk work in permitted confined space areas are thorough and comprehensive. Ventilation provisions, exposure measurements, physical safety considerations, and personal protective equipment (PPE) were correct and well specified. Guidance in the ES&H Manual includes a good logical checklist for evaluating potential confined spaces in cases where the spaces are identified by maintenance or the line organizations. The ES&H Manual also provides comprehensive decision logic for exhaust air handler confined spaces to ensure that exposure assessments are performed and that the space is kept safe for entry and work activities.

FMOC has implemented an employee-run safety committee for maintenance to identify, analyze, and support resolution of safety concerns associated with maintenance work activities. The committee resolves some safety issues and raises other issues for management action. The program has improved safety.

The OA team identified safety concerns with the hazards analysis of potential confined spaces. Several heating, ventilating, and air-conditioning (HVAC) plenums have missing or inconsistent permitted confined space postings, which could result in entry to these spaces without the appropriate controls. The deficiencies present potential unrecognized hazards both to workers and other personnel who may encounter these spaces. Some confined spaces are not on the site's confined space inventory, including several air-handling units (AHUs) on the roof of Building 831. Because those spaces are not on the inventory, there is no documented evidence that the spaces have been evaluated and properly posted as required by OSHA 1910.146, *Permit-Required Confined Spaces*. A few of those spaces are permitted confined spaces and therefore would require permitted confined space postings or equivalent protection to warn employees of the hazard (e.g., locked or bolted shut). There are also deficiencies with the confined space postings of AHUs in the Building 878 basement equipment room. One non-permitted confined space was marked as a confined space in error, and one permitted confined space was not posted or equivalently controlled. Work orders and job plans frequently do not identify that work will be conducted in permitted or non-permitted confined spaces and do not identify the hazards and controls for that work. (See Finding #9 in Core Function #4.)

Unrecognized safety hazards and housekeeping weaknesses in various buildings and spaces indicated the need for increased day-to-day attention to detail by managers, building personnel, supervisors, and workers. In the Building 880 mechanical equipment room, a raceway cover over energized wiring (insulated) was not installed, a junction box and conduit cover were missing, and wiring residue from recent modification work had not been cleaned up. Stairwell lighting for a stairwell to an adjacent equipment room was out, creating a hazard when using the stairway. A protective cover was not installed over energized (insulated) wiring on an air dryer for the service air compressors in the Building 878 basement equipment room. In the same room, water leaking from an overflowing water tank was accumulating in puddles under electrical control panels. On the roof of Building 831, a railing section on a recently replaced roof AHU was missing creating a fall hazard. Additionally, floor grating on the same AHU was incomplete, resulting in step-through hazards.

FMOC has not ensured that a systematic method is implemented to document the hazards and controls for day-to-day work activities in Maximo work orders and job plans. The Maximo work order system and

job plans would easily accommodate inclusion of job-specific and facility hazards and required controls; however, the SNL/NM practice is that the hazards and controls associated with skill-of-the-craft jobs do not need to be documented. A wide range of hazards are considered skill-of-the-craft and are not fully identified, analyzed, or documented on preventive, corrective, and troubleshooting work orders. Therefore, a number of job hazards (e.g., confined space, elevated work, lockout/tagout, welding/burning, etc.) are not always identified on the Maximo work orders. Work orders are frequently issued to the craft with little or no hazard information (or controls) tailored to the specific work or the environment where the work is performed. The FMOC JSHE process was useful when used; however, the thresholds are not well specified, and few JSHEs are performed for routine maintenance work. Applicable PHSs and FMOC operating procedures are rarely listed on the Maximo work requests. Weaknesses in this area were identified during the 1997 Independent Oversight evaluation of safety management at SNL/NM. Job-specific hazards and controls continue to be missed because a well-defined activity-level work control system is not in place. (See Finding #7 in Core Function #3.)

In the waste management organization, the PHS and hazards analysis processes have been applied to major facility activities and operations as required by the ES&H Manual and include identification of key facility and waste management activity hazards. For example, at RMWMF, PHS and/or hazards analysis documents are in place for base operations, sorting, treatment, nuclear facilities operations, and macro-encapsulation. Routine activities, such as waste movements and pickups at generator facilities, are addressed by the base operations PHS. The hazards present in lower-level tasks and work activities not covered by upper-level PHS and/or hazards analysis documents are normally expected to be presented in individual technical work documents and work plans, which are required to be developed in support of these activities.

Similar to the examples above, in the waste management area, not all hazards posed by individual tasks being performed have been identified through the PHS process or in technical work documents that govern activity-level functions. There was also no clearly defined method in place to ensure that all hazards at the task level are consistently identified and documented. As indicated, the primary mechanism for communication of task-specific hazards at RMWMF is the specific work plan developed to govern the individual work activity being performed. However, there is limited guidance available to plan developers regarding expectations on the type, level of detail, and format of hazard identification information to be presented within work plans. As such, the presentation of hazard information was inconsistent and, in some cases, deficient across various work plans reviewed. In several work plans for sorting materials, different authors listed a variety of hazard information in places other than the hazard listing section, where it should be located. One exception to this was the I-125 Treatment work plan which provided required hazard information in the appropriate section of the plan.

Other plans contained incomplete hazard listings for the work being performed. For example, some industrial safety hazards were not identified in the PHS/hazards analysis or work plans for Type IV sorting, including head bump hazards associated with the glovebox door in Room 103W, and the presence of sharp tools (box cutters) for slicing open plastic bags. Similarly, the work plan for high efficiency particulate air (HEPA) filter sampling did not identify the pinch hazards associated with a paper shredder or the ergonomic difficulties associated with placement of filter material into the shredder, resulting in a need to change planned operations during the work. Formal work control processes for some waste management operations do not sufficiently identify, analyze, and document activity-level hazards. These concerns are related to similar work planning and control systematic deficiencies noted above and are presented later in this report. (See Finding #7.)

Within line organizations, all divisions were required to complete a 100 percent high-rigor walkthrough of their spaces in August 2001 to identify radioactive materials and devices that were not properly controlled or labeled. These walkthroughs may have resulted in additional legacy waste being sent to the

RWNMDD. The RWNMDD long-range planning efforts could benefit from collecting and consolidating information on the amounts of radioactive materials (e.g., contaminated experimental material) remaining within the divisions.

Summary. At the institutional level, the ES&H Manual provides an adequate hazards analysis process, although non-conservatism in the question set for the PHS process may result in inadequate hazards analysis rigor, a lack of review and approval for higher-hazard non-nuclear activities, and exposure assessments that are not conducted. At the activity level, most Z-Machine hazards are adequately identified and analyzed. At AMPL, most hazards are adequately identified; however, the hazards analysis process lacks structure and is often not well documented, resulting in cases where the most likely hazards and appropriate hazard controls for a specific activity hazard cannot be identified. While most hazards posed by waste management operations have been identified, the lack of a clear task-level systematic hazards analysis process has resulted in some hazards not being identified in individual work plans. The identification and analysis of hazards for project work and larger jobs, such as maintenance outages, are more comprehensive and rigorous. JSHEs for some maintenance confined space jobs were comprehensive and well documented. For many routine day-to-day maintenance activities, the identification and documentation of hazards on Maximo work orders and job plans was inadequate. Increased management attention is needed to ensure that the appropriate level of rigor is applied to institutional and activity-level hazard analyses.

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.

Institutional and Facility-Level Hazard Controls. At SNL/NM, institutional and facility-level hazard controls consist of engineering controls and administrative controls. (See Appendix F for a discussion of controls for selected essential systems.)

Programmatic Work. At SNL/NM, institutional and facility-level hazard controls for programmatic or research and development work consist of engineering controls (e.g., room and laboratory hood exhaust ventilation), and administrative controls (e.g., ES&H Manual and safety analysis documents). In general, hazards for programmatic work were adequately controlled at the facility-level by effective engineering controls. For example, laboratory fume and downdraft hoods were routinely calibrated and maintained in accordance with industry standards. Equipment and facility interlocks, when required, were adequate and effective.

Facility hazards analysis documents, such as safety analysis reports, safety analysis documents, safety assessments, hazards assessments, and PHSs, identify the bounding controls for most facility-level hazards for programmatic work. At AMPL, the hazard controls collectively identified in PHSs bounded the activity-level hazards, although in a number of cases the hazard controls could not be linked to specific hazards. The PHS format does not facilitate linkage of hazards to specific controls. At Z-Machine, the facility-level controls are effectively implemented through the safety assessment document, the PHS, the facility hazards analysis, and administrative procedures.

Eliminating facility hazards or identifying hazard controls to mitigate risk associated with programmatic work is initially accomplished using the results of the PHS, and is implemented through facility-level technical work documents, training, worker involvement, and division ES&H support teams. The ES&H Manual provides institutional hazard controls in the form of programs, safety requirements, and guidelines for sitewide implementation. For example, the manual provides the basic requirements and guidelines in such topical areas as industrial hygiene, industrial safety, and waste management. Within

these topical areas, basic requirements and guidelines are provided for such programs as the confined space program, lockout/tagout, and mixed waste management.

While the ES&H Manual provides some direction for implementing most regulatory requirements, the breadth and depth of information provided in the ES&H Manual is sometimes insufficient for line management to identify or implement the appropriate facility- or activity-level controls. For example, although Chapter 21 of the ES&H Manual ("Technical Work Documents") provides some generic instruction on the development of technical work documents, guidance is lacking on how or whether hazards and controls are to be documented in technical work documents. In general, there are no clear requirements in the ES&H Manual for incorporating the core functions of ISM into technical work documents. As a result, some divisions or facilities (e.g., AMPL) have not developed a programmatic work control process that clarifies how hazards and controls are to be identified in work documents, and some hazard controls are missed as discussed in the following paragraphs. SNL/NM guidance is also lacking as to the basis for when to include additional instructions or requirements in the ES&H Manual that may be of value to line management in defining hazard controls, especially when such guidance or requirements are not mandated by external regulations. For example, airborne lead exposure is a potential hazard to some workers at AMPL and across the site. However, because the airborne concentrations of lead are currently less than the OSHA action level, a written lead program is not required by OSHA; furthermore, guidance on lead hazard controls is not provided in the ES&H Manual or the PHS process. During the past three years, there have been two occurrences at AMPL involving worker exposures to lead. In the July 2000 occurrence, an exposure above the OSHA Permissible Exposure Limit was recorded. A corrective action identified in the occurrence report was to "contact the ES&H Manual Committee regarding the lack of guidance to the line on OSHA regulations concerning lead processing." However, no changes were made to the ES&H Manual. In another example, the ES&H Manual does not provide sufficient guidance for the identification and control of chemical carcinogens, as required by DOE 440.1A, Section 18(k), which requires that the contractor develop "policies and procedures to mitigate the risk from identified and potential occupational carcinogens." (See Finding #7.)

Maintenance. During the review of construction and maintenance work and program requirements, similar concerns were identified with the application of institutional administrative controls. In particular, electrical safety concerns were identified and are applicable to the sitewide electrical safety program. For example, the SNL/NM Electrical Safety Committee improperly approved the use of a less restrictive provision of National Fire Protection Association (NFPA) 70E in lieu of lockout/tagout requirements for equipment servicing mandated by OSHA 1910.147. This less restrictive set of controls increased risk to workers by allowing maintenance personnel to perform electrical and mechanical maintenance on equipment that was not under lockout/tagout over an extended period of time (over two years). This allowance was also approved by the SNL/NM Electrical Safety Committee even though the committee had documented that OSHA issued an interpretation indicating that an extension of this type of allowance was not acceptable. The Electrical Safety Committee did not document a justification for adopting the less restrictive standard. Because of the identified programmatic concerns, additional performance deficiencies in lockout/tagout, and previous SNL/NM external and internal lockout/tagout audit issues, SNL/NM stood down all work involving lockout/tagout (except by construction subcontractors) during this OA inspection. SNL/NM also adopted the more restrictive standard as part of the SNL/NM lockout/tagout stand down. Re-start criteria for lockout/tagout work included retraining and retesting of all lockout/tagout "authorized" personnel, and certification by line managers that all "authorized" personnel had been briefed and understood their lockout/tagout responsibilities. (See Core Function 4, Finding #9.)

The lack of specific requirements in the ES&H Manual pertaining to technical work documents has also impacted maintenance planning work activities. Currently the ES&H Manual, Chapter 21, does not contain a minimum set of requirements for all technical work documents to ensure that hazards and

controls are integrated into all technical work documents. For maintenance activities, Maximo work orders and job plans are not addressed in technical work documents. The lack of specific requirements for some technical work documents may have contributed to inadequate work documents at the activity level and inadequacies in work performance as discussed in Core Function #4.

Waste Management. At the institutional level, hazard controls for waste management activities are generally robust, particularly in the area of pollution prevention where SNL/NM has been credited for successfully implementing a variety of pollution prevention initiatives addressing hazardous waste, radioactive waste, solid waste, water/wastewater, and air emissions. According to the SNL/NM Pollution Prevention Program Plan, each generator of hazardous, mixed, radioactive, and solid wastes is required to identify and analyze the pollution prevention and waste minimization opportunities and the measures for the promotion of source reduction and resource reuse/recycle. The SNL/NM pollution prevention coordinator provides technical support to facilitate these pollution prevention opportunity analyses and their implementation when cost-effective and feasible. These efforts have resulted in several DOE pollution prevention awards and a White House Closing the Circle award between 1999 and 2002 in the areas of fleet services, affirmative procurement, sustainable design, and energy management. In addition, the SWTF sorts 100 percent of all solid waste to ensure that no unauthorized wastes are offered for disposal. The sorting also effectively facilitates recycling/waste minimization possibilities. The SWTF recycles cardboard, white paper, aluminum cans, plastic, computers, and other materials. Non-recyclable wastes are baled to reduce the landfill volume and tipping fees.

At the facility and line organization level, SNL/NM has established an extensive control program for the generation of radioactive and mixed waste. As part of these controls, a waste certification official provides training and certification of generators. Sections 19B and 19C of the ES&H Manual also provide generators with effective guidance on managing radioactive and mixed waste. The SNL/NM Hazardous and Solid Waste Department has matrixed environmental protection representatives to line organizations to support line organizations and provide the interface between line personnel and environmental subject matter experts (SMEs) for environmental protection.

Although the waste management program had many strengths, some deficiencies in hazard controls were identified. Within SNL/NM line organizations, adequate administrative controls were not in place to ensure that waste generators appropriately manage hazardous and non-regulated wastes at the point of generation so that effective characterization by waste type can occur prior to disposal. For example, within some line organizations, containers labeled as hazardous waste are used to collect oily rags even though they are not hazardous waste under the New Mexico Resource Conservation and Recovery Act (RCRA) program and therefore are disposed off site as non-regulated waste. At another facility, red step-on cans used to collect oily rags are labeled hazardous waste and located throughout the work areas, which could result in solvent rags (RCRA hazardous waste) being placed in these cans labeled as hazardous waste.

The SNL/NM line organization is responsible for certifying that the information on a disposal request is correct when submitted. Although selective confirmation of waste packages occurs at the HWMF as deemed appropriate, proper characterization of waste package content for the preparation of offsite disposal manifests relies on accurate information provided by the line organization generators. Within line organizations, environmental protection representatives provide support to generators; however, waste management SMEs from the ES&H organization are not usually requested by line organizations to periodically review waste generator activities, which would provide a more justifiable basis for certifying that waste manifest information is true and complete.

Activity-Level Hazard Controls. At SNL/NM, activity-level hazard controls consist of departmental administrative controls (e.g., procedures, postings, and permits) and PPE when engineering or

institutional administrative controls are insufficient or impractical. The OA team identified numerous examples of administrative and personal protective controls that were well defined and effectively implemented at the activity level. However, several concerns were also evident, particularly in programmatic work and waste management areas as further explained in the following paragraphs.

Finding #7. SNL/NM work control processes are not sufficiently documented to explain how activity-level hazards and controls are to be identified, analyzed, and documented, and how hazard controls are to be linked to activity-level hazards.

Programmatic Work**.** Activity-level administrative controls for most hazards at the Z-Machine were documented and identified in technical work documents, permits, signs, and other administrative controls, such as operator aids. At Z-Machine, administrative controls for hazards associated with routine operations (including conduct of shots) and programmatic maintenance are implemented primarily in procedures and supplemented by checklists, permits, postings, operator aids, and other technical work documents. The Z-Machine has a comprehensive administrative procedure for the approval, control, and review of both new and existing administrative and technical documents. The review process for all new and revised technical procedures has a required signoff by the facility ES&H coordinator to ensure that all hazards have been addressed. The technical procedures at Z-Machine are generally well written and provide an adequate level of detail to ensure that the tasks can be performed safely. Prerequisites, notes, and cautions are appropriately used to convey hazard controls. In all but one case, these administrative controls were effectively maintained. In the one exception, operator aids at Z-Machine were not controlled to ensure that the latest revision was always in the workplace. Once discovered, the facility took immediate steps to correct the deficiency in the process.

AMPL administrative requirements for programmatic work control are typically less structured than those at Z-Machine because the nature of AMPL work is different, varied, and constantly changing. At AMPL, the service work request is the initial process for defining most work and ensuring that hazards are analyzed, controls are identified, and work is appropriately authorized. However, ES&H and work control requirements for use of service work requests are not defined in divisional procedures or instructions.

In addition to the service work request, hazard controls are also identified by one or more PHSs and in a variety of technical work documents (e.g., work instructions and safe operating procedures) that supplement the controls identified in a PHS. However, there is no clear, documented guidance within AMPL for the development, use, approval, and revision of technical work documents; how hazards and controls are to be identified; or when ES&H is to be involved in reviewing or approving such documents. As a result, hazard controls for some work activities are missed or are not clearly linked to the hazard they are intended to control or mitigate. The OA team noted that some appropriate hazard controls could not be identified and/or linked to the work hazard in three of the four AMPL departments where work was observed. For example, workers in the Organics Department were using small quantities of methylene chloride (a solvent and suspect carcinogen). The technical work document for this activity, the Organics Department ES&H Safe Operating Procedure, required that when using solvents, the hazard control recommendations in the MSDS must be followed. However, based on the nature of the operation, the controls in the MSDS may not have been appropriate, and in any case were not followed. The PHS that bounded this activity did not identify any hazard controls for the use of methylene chloride (e.g., PPE and local ventilation). The ES&H Manual and PHS required the area to be posted as a "designated area" when highly hazardous chemicals (such as methylene chloride) were in use; however, the area in which the work was performed was not identified or posted.

Although most worker training at AMPL is appropriate and kept current, some training requirements for this activity were unclear in the PHS and were not specified in other technical work documents. For example, there was no record that the workers using the methylene chloride had received a briefing or work area-specific hazard communication training in using methylene chloride, as required by the OSHA Hazard Communication Standard (29 CFR 1910.1450).

In another example of programmatic hazard controls, the hazards and minimum hazard controls (i.e., PPE) for performing equipment degreasing in the AMPL Thin Films and Vacuum and Packaging Department could not be identified by workers performing the activity or in postings or technical work documents. In one case, workers did not wear chemical gloves when their hands were in contact with trichloroethylene vapors. This informal hazards analysis and controls process does not adequately address some job-specific hazards, and when job-specific hazards are identified, the hazards analysis process often does not identify specific (or minimum) controls to mitigate the hazard. Consequently, for several observed work activities, the appropriate hazard controls could not be identified and/or linked to the work activity hazard.

Construction and Maintenance. Health and safety plans for construction and service contractors addressed appropriate ES&H hazards and controls that are required to safely perform work at SNL/NM. The OA team visited several construction and service contractor work areas and reviewed the health and safety plans for the work being performed. The plans were generally well written, addressed required ES&H functional areas, and were consistent with SNL/NM requirements. Deficiencies were identified with implementation of some health and safety plan requirements, as discussed in Core Function #4.

For SNL/NM maintenance activities, FMOC has developed sound operating procedures to govern implementation of corrective and preventive maintenance. With few exceptions, operating procedures are appropriately based on upper-tier requirements and standard industry practices. The operating procedures have comprehensive guidance for mechanical, structural, and electrical maintenance. Maintenance operating procedures are controlled documents that receive periodic review and revisions when upper-tier requirements change. The operating procedures are addressed in training programs, and all workers must sign acknowledgements that they have read and understand the procedures.

FMOC has also developed several controls/initiatives to improve worker safety, provide better direction to workers, and provide feedback to workers. These control/initiatives include an FMOC hearing loss prevention program, task-based noise exposure evaluations, confined space awareness fact sheets for new employees, medical back care program enrollment for all maintenance workers, a refrigerant compliance manager program, and web-based information for self-assessment, operating procedures, injury data, and ISM system training. In addition, custodial services transitioned to an "Operating System One" program emphasizing safety, ergonomics, and efficiency. As a result, lost workday cases for custodians dropped from 71 days in 2001 to 3 days in 2002 after transitioning to Operating System One.

However, as discussed under Core Function #2, FMOC has not ensured that a systematic method is used to document task-specific hazards and controls for routine maintenance work activities in work orders and job plans. Thus, work orders are issued to the craft with little tailoring of the controls to the work activity. Applicable PHSs and FMOC operating procedures are rarely included or referenced in work orders. The ES&H Manual does not establish sufficient requirements and direction to ensure that hazards and controls are integrated into all technical work documents, such as Maximo work orders and job plans for maintenance work. As a result, specific controls for safely performing work can be missed. (See Finding #7.)

Waste Management. At RMWMF, a comprehensive waste-tracking database system is being used to effectively track current information on drum and container content, location, waste history, and other

necessary information for proper management of radioactive and mixed waste. A bar coding system is used on all containers, and all containers are stored indoors. Radioactive waste characterization systems were comprehensive and included direct radiological measurements and analyses during the repackaging and inspection operations as well as gamma spectral analysis of packaged waste containers.

For radioactive waste storage, DOE Order 435.1 sets limits on the length of time waste can be stored, with allowance for the Field Element Manager to approve variances using a graded approach in a specific Radioactive Waste Management Basis document. However, the SNL/NM radioactive waste management basis for DOE Order 435.1 does not specify whether order requirements related to length of storage will be exceeded or what mitigating actions will be taken if DOE-imposed time restrictions are not met. In addition, DOE has not approved the basis document.

Radioactive waste storage conditions were generally protective of the waste materials. However, one concern was that wooden pallets used to hold drums were in poor condition. Although none of the observed drums on pallets were double or triple stacked, procedures allow stacking drums to three levels and do not include restrictions on the use of pallets in poor condition. SNL/NM personnel indicated that this situation has been corrected.

Several approved work plans at RMWMF have discrepancies in the specification of some required controls and in some cases had missed controls or inconsistent application of controls for the same work. For example, individual work plans for working with similar waste materials did not always specify the need to contact Industrial Hygiene if beryllium waste was encountered. Individual work plans defined PPE requirements differently for working with similar waste materials, such as not specifying the need for coveralls, safety shoes, shoe covers, and similar controls needed for the work. Several work plans did not require leather gloves to protect glovebox integrity or hands from sharp objects and tools, or justify why puncture resistant gloves were not needed. Work plans were also inconsistent in the level of detail and specificity regarding PPE requirements, such as single or double gloves and shoe covers. (See Finding #7.)

In the radioactive waste operations area, the SNL/NM RWNMDD and the waste management subcontractor have a highly qualified and stable workforce, which contributes to the safety of reviewed operations. The workforce includes a number of personnel with significant experience and qualification in health physics and safety disciplines, including several Certified Health Physicists and other degreed professionals responsible for overseeing work. A minimum level of qualification is required for some positions at RMWMF, such as sorting supervisors who direct day-to-day field activities involving exposure to radioactive materials and other hazards.

Operation of RMWMF involves a significant amount of radiological work due to ongoing waste handling, inspection, and repackaging activities. While generally effective due to the direction and control provided by qualified supervisory personnel, the radiological control process at RMWMF was not being implemented in a manner that ensures that all controls are clearly identified, documented, and understood by workers and ES&H personnel prior to performing work, as required by the ES&H Manual and as further detailed in the following paragraphs.

The ES&H Manual requires the use of job-specific radiation work permits (RWPs) as the mechanism for defining the necessary radiological controls for work with the potential for changing radiological conditions. Workers are required to read and sign each job-specific RWP prior to initiating work activities. However, for various reasons, this mechanism was not considered the most suitable method of work control at RMWMF and was internally modified by RWNMDD. In response to an internal audit, RWNMDD later prepared a formal deviation request and was granted an exemption from the requirement to use job-specific RWPs by the site's Radiation Protection Department (SNL/NM 3123). The exemption

was based on an assumption of equivalent or superior controls through the use of the technical work document process for definition of radiological controls. However, the technical work documents in place currently do not provide an equivalent method of hazard controls when compared to the institutional RWP process. The current method has some weaknesses, including a variety of unlinked documents that specify radiological controls, some controls that are not linked to specific work evolutions, and a potential for incomplete worker accountability and understanding of requirements. Documents that identify the specific radiological controls for a particular job include work plans and supplements, which do not require authorized user lists under RWNMDD Administrative Operating Procedure (AOP) 94-12. However, institutional RWP requirements require workers to read and document their understanding through a written concurrence before initiating work activities. The application of an authorized user list for work plan documents may be sufficient to satisfy the ES&H Manual requirements. However, the current process as implemented results in a less stringent method than a job-specific RWP and has the potential for incomplete worker understanding and accountability.

In a related concern, there was inadequate flow of communication between the line organization and other SNL/NM environmental departments with regard to certain RMWMF radiological controls that could impact safety. For example, the ES&H customer support team believed that routine bioassay for isotopes other than tritium was implemented as a special control by SNL/NM 3123 for a group of RMWMF workers. However only RMWMF radiological control technicians (RCTs) were placed on this program. Since the RCT's duties and exposure scenarios differ significantly from other waste management workers, bioassay results for RCTs might not be representative of other workers because the other workers may perform different activities involving different hazards. Similarly, SNL/NM 3123 internal dosimetry program personnel were unaware of the differences between the waste management subcontractor's respiratory protection program and the SNL/NM program as it relates to formally assigned protection factors for supplied air bubble hoods being used. As a result, Internal Dosimetry was significantly overestimating the protection factor of the bubble hood in use at RMWMF (1,000 versus the assigned protection factor of 25 stated in the waste management subcontractor's respiratory protection program). With these conditions, resulting dose calculations for potential intakes may be biased low, with a potential to adversely affect the ability of Internal Dosimetry to make proper decisions related to the need for follow-up bioassay and/or assigned internal dose.

Finding #8: SNL/NM and the waste management subcontractor have not ensured sufficient formality in implementation of the radiological controls at RMWMF consistent with the requirements of the ES&H Manual (e.g., job-specific radiation work permits or equivalent) such that all controls are clearly identified, documented, and understood by workers and all ES&H personnel responsible for radiological safety.

An example of a potential intake scenario at RMWMF occurred in 2002 when a breathing zone sample result exceeded the defined Internal Dosimetry action level for alpha activity. The counting lab made a verbal notification to the Internal Dosimetry organization; however, the matter was not formally tracked or documented because the initial calculated dose was low. However, that low dose was based on the incorrect respiratory protection factor. Internal Dosimetry procedures require opening a formal Internal Dosimetry investigation file for cases of suspected intakes; however, one was not created in this case because there was no clear threshold requirement for initiating the procedure. The lack of a requirement to initiate a documented file for reporting elevated breathing zone air sample results to Internal Dosimetry affects the ability to recreate past events and prior decision-making. In this example, a parallel and independent investigation of the elevated result by the waste management subcontractor concluded that the primary isotope was U-234 and the resulting dose was less than 1 millirem (mrem) and therefore did not require further action.

In another concern, it was determined that the level of rigor applied to radiological workplace air sampling at RMWMF does not ensure that all work areas are completely characterized consistent with site respiratory protection, internal dosimetry, and posting requirements. Most work plans require the use of continuous air monitors (CAMs) to monitor for airborne radioactivity; however, these devices cannot always be relied upon to determine airborne concentrations at the sensitivity necessary to evaluate the need for posting as airborne radioactivity areas and for relaxation of entry controls to areas where respiratory protection devices have been in use. Breathing zone samplers were appropriately required when respiratory devices were prescribed. However, breathing zone or other air sampling is not required for Type IV work in gloveboxes; only CAMs are required during glovebox work. Typically, no other air monitoring (such as fixed air heads, grab samples, or personal breathing zone monitoring) is conducted to quantify the potential for elevated air concentrations (below the CAM sensitivity) should the integrity of the glovebox containment system be unknowingly compromised during the work. In the past, workers have experienced breached gloves during work activities.

Summary. At the institutional and facility level, engineering controls (such as building ventilation systems and equipment interlocks) are generally well established, appropriately installed and maintained, and adequately designed to control the intended hazard, with some exceptions. Institutional and facility-level waste management and pollution prevention controls have been established and are effectively implemented. In general, training and qualification programs for those areas evaluated by the OA team were adequate and current. However, the OA team identified several concerns with institutional controls, particularly the lack of guidance in some sections of the ES&H Manual, a non-conservative approach to implementing some lockout/tagout requirements, and inadequate waste segregation controls in the line organizations to ensure an effective characterization of waste type.

At the activity level, controls for construction and most controls for FMOC maintenance activities have been developed and appropriately implemented. Several initiatives have been implemented within FMOC to improve safety, and measurable results are evident. A number of waste management controls at the activity level were effective, such as the maintenance of radioactive waste inventories; however, some controls were missed or poorly identified in work plans. For programmatic work, hazards associated with routine large-scale operations, such as Z-Machine operations, are sufficiently controlled through well-defined administrative controls, processes, and PPE. However, when similar work control processes are applied to programmatic work that is varied, transient, and changing (such as at AMPL), hazard controls are not consistently sufficiently identified, linked to the appropriate hazard, or adequately communicated to workers through training, postings, or procedures and instructions. Similarly, the radiological control process at RMWMF is not being implemented in a manner that ensures that all controls are clearly identified, documented, and understood by workers and radiological safety personnel prior to performing work.

Overall, improvements are needed in the development and implementation of hazard controls, particularly with respect to institutional and activity-level administrative controls, development of activity-level work control processes, and formality in implementation of radiological controls.

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

Readiness is confirmed and work is performed safely.

Programmatic Work. SNL/NM line organizations use several methods to confirm readiness for program work. At Z-Machine, approval for performance of experiments is formal, and the level of approval is appropriately based on the hazards as well as whether hazards analysis and controls are new or already established by a previous experiment. Approval to perform a pulsed power shot is rigorous and ensures that appropriate safety precautions and systems are in place. The accelerator activities

coordinator performs a readiness checklist involving all affected parties. The checklist process consolidates readiness checklists from all groups responsible for Z-Machine subsystems and ensures readiness of people and subsystems. Final personnel sweeps of the areas and arming of the access control system ensure that all personnel are safely evacuated prior to initially applying high voltage to the machine.

At AMPL, the PHS process provides a mechanism for line management to formally authorize work bounded by the hazards described in the PHS. However, because a single PHS often bounds a variety of work activities and hazards that frequently change within a department, the PHS is not sufficient to confirm readiness to perform some specific work activities. In a number of cases, as described in Core Functions #2 and #3, neither the hazard nor the control was explicitly described in the PHS. Therefore, at AMPL, the PHS work authorization process has been informally supplemented with other activity-level work authorization processes and documents, such as technical work documents and the service work order. Although the use of these other processes may provide an adequate mechanism to authorize work at the activity level, AMPL line management has not established or documented expectations for the use of these documents to authorize work.

All workers interviewed at both the Z-Machine and AMPL were aware of their stop-work responsibilities and authority and indicated they would not hesitate to stop work if they observed or were asked to perform questionable or unsafe work activities. The workers displayed a safety-conscious attitude and did not have concerns about intimidation or production pressures that would affect safety or inhibit them from raising safety concerns or exercising stop-work authority.

Most work activities at Z-Machine were safely performed by highly skilled and experienced workers and supervisors using established controls and appropriate PPE. The work included programmatic work, research activities, and maintenance on programmatic equipment. The accelerator activities coordinator effectively performed all required duties for allowing experiments to proceed. The coordinator maintained a constant awareness of the status of all subsystems during experiment preparation, and effectively ensured the safety of the machine and workers in the affected area. Workers appropriately controlled suspended load movements and maintained a 10-foot exclusion area around the load during crane movements for removal, transport, and installation of large machine internals. RCTs performed thorough and appropriate contamination surveys of machine internal components. Workers performed installation of the wire array and performed diagnostics alignments within a non-permitted confined space in accordance with confined space requirements. In all these cases, workers performed work safely in accordance with the appropriate ES&H requirements.

Work activities observed at AMPL were also performed safely by technical staff and technologists who were highly skilled, experienced, and knowledgeable of the work and area hazards. When hazard controls were explicitly defined in technical work documents at AMPL, the controls, with some exceptions, were adequately implemented. For example, technologists performing synthesis of lead niobium zirconium titanate (PNZT) followed the hazard controls as stated in the PNZT work instructions (protective clothing, respirators, and the use of local ventilation systems). However, when hazard controls were stated generically in technical work documents, such as "follow the requirements in the applicable MSDS," the controls were often informally modified by the workers and/or line managers, and were not followed as stated. In other cases, as described in Core Function #3, when hazard controls for a specific work activity were not identified in AMPL work documents, it was unclear whether the appropriate controls were followed.

Although most work at Z-Machine is performed safely, the OA team observed numerous deficiencies in which workers did not follow the prescribed procedures and hazard controls while performing work. For example, during the gas switch replacement work, fall protection PPE requirements were not

implemented as required by the confined space permit, and PPE requirements for use of hexane were not followed as required by the operating procedure. Over a period of one week, multiple workers entered permitted confined spaces under at least eight separate expired confined space work permits (multiple people and permits). In one operation, workers also violated several requirements of the SNL/NM and Z-Machine lockout/tagout procedures by performing work without an adequate lockout/tagout. Workers replacing a beam tube failed to ensure that a lockout/tagout was on the laser, preformed an inadequate verification, and signed on the lockout/tagout without verifying it was complete as specifically required by procedure. In another example, a worker was observed transferring liquid nitrogen without the prescribed PPE, specifically a face shield and thermal gloves. (See Finding #9.)

The deficiencies indicate several cases where workers were not demonstrating a safety-conscious approach to their work activities and were not always following established hazard controls required by procedures and other technical work documents. The number of deficiencies indicates a degree of complacency by supervisors and workers and failures to rigorously follow established safety requirements.

Construction and Maintenance. Readiness to perform work is a formal process for construction work and service contractors. The process includes a review of contract provisions with the contractor, post-award meetings, review of procedures and safety plans, and formal notices to proceed with work. For service contractors, individual service tasks, such as maintenance work, are controlled by issuing the Maximo work orders to approve and authorize the work. Service contractor accountability representatives and maintenance team leaders release work to service contractors and maintenance craft respectively. Team leaders and craft coordinate with facility managers, building managers, and building operators for permission to start work before performing work in facilities. The work release process (verifying conditions are safe, just prior to releasing work) was in place but was largely informal for routine maintenance work.

Construction work at three major construction sites (JCEL, Buildings 762, and 969) was being safely performed with few observed deficiencies. Workers were wearing appropriate PPE for their assigned work, and construction areas were properly barricaded and posted. Fall protection provisions were appropriate and the work and lay-down areas were orderly. Heavy equipment, such as cement trucks, pumping trucks, dump trucks, cranes, and tractors, was safely operated. Supervisors and the contractor safety officers were at the work site, and construction inspectors visited construction areas frequently.

FMOC maintenance personnel who were observed performing a variety of preventive and corrective maintenance tasks were experienced and knowledgeable in their technical trades and craft. Workers were cognizant of hazards and safety requirements, and indicated that they would not hesitate to stop work based on safety questions. Maintenance management appropriately stopped work for safety concerns during Building 851 bridge crane work.

The OA team observed numerous jobs that were safely and appropriately performed. Service contractors were performing numerous excavations and many were safely performed in accordance with safety plans and excavation permit requirements.

Inspection of several maintenance shop areas indicated that they are being well maintained to keep the work areas safe and free of hazards. Areas such as the carpenter shop, sheet metal shop, and painting shops were neat and clean, and the working spaces were free of safety deficiencies and hazards. Storage was orderly, and power panels, eyewash stations, and machine disconnects were not obstructed.

Although most work was performed safely, the team observed several unsafe work practices and deficiencies caused by failures to follow procedures and program requirements, resulting in potential risks

to workers. As discussed below and in Finding #9, unsafe work practices and safety concerns were identified in lockout/tagout, excavations, fall protection during roof work, and confined space evaluations.

Deficiencies in the implementation of lockout/tagout requirements had potential to cause serious injury to workers. Although there were no energized exposed parts, there were failures to test the lockouts before starting work and failure to verify zero energy. As discussed in Core Function #3, a significant amount of maintenance and servicing work was allowed to be performed on equipment without proper lockout/tagouts. During a preventive maintenance work activity on four exhaust fans, both workers failed to test the lockout/tagout, as required by OSHA 1910.147 (d) (6), before performing hands-on work on the equipment. This situation went unnoticed by the maintenance team leader until prompted by the OA team member. Neither worker attempted to start the fans using the start/stop switch to verify the isolation before starting work. During another maintenance job, a worker performing a preventive maintenance on an exhaust fan turned off the fan, did not apply a lockout/tagout, and failed to perform verification of isolation or a zero energy check on the equipment before starting work. Several lockout/tagout tags were missing the worker's supervisor name and telephone number, which are required by the FMOC lockout/tagout procedure. Maintenance team leaders took immediate action to correct the deficiencies and held group and individual safety briefings to re-instruct workers on lockout/tagout requirements.

Weaknesses in implementing fall protection and deficiencies by a service contractor resulted in risk to workers during Building 831 roof work. The warning lines were not positioned at least six feet from the unprotected edge for all stanchions along the edge as required by OSHA regulations and the service contractor's safety plan. During the work, a monitoring watch stepped to an unprotected edge of the roof to look over the edge. Although the workers were wearing hearing protection (requiring a line of sight positioning so that visual cues could be given if workers got too close to the edge), the monitoring watch was not always positioned to alert the two workers outside the warning line on the unprotected edge of the roof. One contributing factor may be that the SNL/NM ES&H Manual, FMOC operating procedures, and subcontractor safety plans do not provide adequate guidance on the proper use of monitoring watches. The SNL/NM team leader paused work to counsel workers and re-emphasize roof safety requirements prior to letting work resume.

FMOC stopped crane installation work in Building 851 because of a concern about a service contractor worker's understanding of job hazards. The worker was involved in providing electrical support to rewire and connect a bridge crane. The worker told OA inspectors that he was working under a lockout/tagout, which turned out to be an unlocked administrative lock. Though the lockout/tagout was not required for that phase of the work, the worker thought it was and assumed a lockout/tagout was in place instead of placing his own lockout/tagout and verifying the lockout/tagout. The worker was not under supervision by the service contractor, but had some supervision by SNL/NM crane safety personnel. FMOC re-evaluated the work activity, personnel assigned, and safety considerations, and implemented additional supervisory monitoring.

The OA team observed unsafe work by a service contractor involving a worker digging in an unshored trench that was about 5 ½ feet deep. The trench was not shored and a soil classification, required by the service contractor's safety plan, had not been documented. SNL/NM's practice is to consider all soil on site Class C soil (loose), thus shoring or sloping would have been required for any trench over five feet deep. An egress ladder, required by OSHA and the service contractor's safety plan, was not available for egress from the trench. The dirt piles had not been kept back from the edge of the trench by two feet as required. The service contractor corrected the deficiencies and held a safety meeting to re-instruct all employees of the excavation and safety plan requirements and documented that action to SNL/NM. On another excavation, two excavation permits were improperly combined into a single excavation permit. The two excavations had different hazards and were separated by a long distance. Combining the two excavations on a single permit created risk by causing confusion because the permit indicated a propane

line had been spotted, which was not true for the second excavation. The data fields on the permit are not designed for multiple excavations on a single permit. Additionally, barricades were not installed properly on a few excavations.

Walkdowns and program review identified some weaknesses in implementing the pressure safety program. Air receiver tanks in the Building 878 basement had certificates of inspection that expired in July 2001 (although they were within their three-year maximum interval). OSHA 1910.169(b)(3)(iv) requires all safety valves to be tested frequently and at regular intervals to determine whether they are in good operating condition; however, adequate testing is not being performed. The service contract to perform sitewide facility tank and relief valve inspections had lapsed, and provisions to perform regular tank and relief valve testing are not yet in place. FMOC had previously initiated an evaluation to determine whether the maintenance organization could perform the testing if a suitable service contractor is not identified. In addition, the past practice of manually opening the relief valves to "exercise" the valves rather than performing set pressure testing is not fully addressed in the SNL/NM Pressure Safety Manual. A special case for non-routine testing is being generically applied for a large number of relief valves without adequate justification. Documentation of tests did not meet pressure safety manual requirements. FMOC is not maintaining data packages approved by the manager and line pressure advisor, and the safety engineering representative or division ES&H team had not been notified in writing of this deficiency.

Weaknesses were identified with housekeeping in some mechanical equipment rooms. The Building 880 Northeast mechanical equipment room has leaking valves, a through-wall pipe leak, storage obscuring power panels, and a surplus hot water heater bundle. The Building 880 Southeast mechanical equipment room has electric wiring debris from recent modifications and seeping circulating water valves. The Building 878 basement equipment room had housekeeping deficiencies as discussed in Core Function #2. Although the rooms are visited regularly by building operators and maintenance personnel, readily evident housekeeping deficiencies had not been corrected, and work requests had not been prepared for all of the deficiencies.

Waste Management. SNL/NM line organizations have implemented RCRA requirements for hazardous waste in accordance with requirements. Satellite accumulation points (SAPs) and less-than-90-day areas were properly operated. Containers were under the control of the generators and were properly labeled, and spill and emergency equipment was in place. For example, red self-closing cans that are near the point of generation are being used to accumulate hazardous waste, and the contents are moved to a less-than-90-day storage area when the cans are full. However, as discussed in Core Function #3, some facilities use these cans in a manner that does not support appropriate controls for classification of wastes.

SNL/NM Pollution Prevention (P2) operations were being conducted consistent with DOE policy and regulatory requirements and meet the DOE Secretary of Energy's pollution prevention and energy efficiency goals for 2005 and beyond. SNL/NM has also established the sitewide "Green Zia" (a state-named program) Environmental Excellence Program Application Team and the Environmental Management System Team. The SNL/NM sitewide programs, when fully implemented, are appropriately designed to be an effective tool for enhancing pollution prevention and control.

At RMWMF, the authorization to perform work is similar to AMPL's work authorization process. The PHS process provides a mechanism for line management to formally authorize work bounded by the hazards described in the PHS. However, because a single PHS often bounds a variety of hazards and work activities that frequently change, the PHS is not sufficient to confirm readiness to perform many specific work activities. In these cases, line management review and approval of job-specific work plans serve as the activity-level work authorization process. Waste management aspects of operations at RMWMF were often effective and were performed in accordance with established controls. Mixed waste

containers were properly labeled and kept closed, spill equipment was available, required weekly inspections were being performed, and all containers were protected from the elements. Radioactive waste operations at RMWMF were performed safely in accordance with instructions from job supervisors, which sometimes were more complete than job work plan information. Pre-job briefings were comprehensive and provided a good level of detail regarding the hazards and necessary controls. Type IV sorting operations were conducted in accordance with the steps included in the container-specific work plan. The radiological surveys and breathing zone sample results reviewed by OA were clearly documented and complete.

Although most line organization hazardous waste management activities were performed in accordance with Federal, state, and site requirements, two concerns were identified. The ES&H Manual requires unknown waste to be assumed hazardous and managed as such. At one facility, grinding on painted metal was stopped when it was determined the paint could contain lead; however, the metal and paint that had been collected from this activity were not being managed in accordance with ES&H Manual Section 19A labeling requirements. At another facility, labeling information indicated that a 55-gallon hazardous waste drum assumed to be full had been in the SAP for 14 days, which exceeds the ES&H Manual requirement of three days to remove wastes when the total volume of waste in a SAP exceeds 55 gallons.

While controls for many operations at RMWMF are generally conservative and followed, some apparent inconsistencies with the potential to impact worker safety were observed. Some aspects of observed operations work at RMWMF were not performed in accordance with controls specified in task-specific work plans. The deficiencies involved a failure to either follow specific PPE requirements specified in the work plans or stop work to seek clarification when work plan requirements differed from information received at pre-job briefings. For example, several work plans had less stringent PPE requirements than similar work plans for the same location. The PPE requirements of these work plans were not clarified before starting work and the discrepancies were not self-identified, indicating a possible lack of attention to the material presented in the written procedure. While not evident in the cases observed, the failure to follow the specified controls or bring discrepancies to the attention of supervision and management before starting work could result in safety concerns and risk to workers. The RWNMDD quality assurance plan requires that all work to be performed in accordance with approved plans and procedures. In another example, a worker did not leave the immediate work area prior to doffing respiratory protection and could have been exposed to low levels of airborne contaminants.

Summary. Most programmatic, construction/maintenance, and waste management work activities were safely performed in accordance with organization-specific job plans, procedures, and environmental requirements. Several major construction projects were in progress, and construction contractors and subcontractors had excellent safety records. For all work reviewed, mechanisms were in place to authorize work and to verify readiness before starting work, although some of these mechanisms were informal. However, there were numerous instances of unsafe work and failures to follow procedures and implement program requirements across several line organizations. Weaknesses were identified in lockout/tagout, confined space, excavation, and fall protection that could cause serious injury to workers. Unsafe work practices and failures to follow program and procedure requirements causes potential risk to workers and indicates a need for additional management and safety organization involvement in day-to-day work activities and programs.

Finding #9. SNL/NM safety programs are not effectively implemented, and operating procedures are not followed in the areas of lockout/tagout, excavations, fall protection, the confined space program, and the pressure safety program, resulting in several unsafe work practices that place workers at risk unnecessarily.

E.3 CONCLUSIONS

Most aspects of work at SNL/NM were performed consistent with the core functions of ISM. Some of the engineering controls and many administrative controls were well designed and effectively implemented. With few exceptions, SNL/NM has established and implemented effective processes for defining the scope of work activities. However, weaknesses were identified in the SNL/NM processes for analyzing hazards and identifying controls. Further, work was not always performed in accordance with established requirements and procedures, and several unsafe work practices were observed.

Improvements are needed in several important aspects of the SNL/NM ISM program, including the ES&H Manual, the PHS process, the USQ process, work control processes (for programmatic work, maintenance, and waste management), and procedural adherence (including the use of technical work documents). Improvements are also needed in several important ISM programs, including lockout/tagout, excavations, fall protection, the confined space program, and the pressure safety program.

In most cases, SNL/NM has a good understanding of the identified weaknesses and has initiated corrective actions for some. However, weaknesses in issues management and corrective action management are a concern at SNL/NM (see Appendix D), thus increased management attention is needed to ensure that the identified deficiencies are fully and effectively addressed at the areas reviewed on this OA inspection and at other SNL/NM facilities and organizations that have similar programs and may have similar weaknesses.

E.4 RATINGS

The ratings of the first four core functions reflect the status of the reviewed elements of ISM programs at SNL/NM.

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

E.5 OPPORTUNITIES FOR IMPROVEMENT

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

SNL/NM

1. **Provide additional detail within the ES&H Manual to assist line management in the control of higher-risk hazards and work control processes.** Specific actions to consider include:

   - Review all chapters of the ES&H Manual and revise as needed to ensure that the ES&H Manual contains all the necessary regulatory and DOE order safety requirements.

   - Include additional guidance in the ES&H Manual to address the minimum corporate expectations when encountering and controlling lead, beryllium, and carcinogens.

- Provide additional guidance on the development, use, and approval of technical work documents, including how technical work documents are to be integrated with the five core functions of ISM.

- Assess technical work documents in use to ensure that line organizations have flowed down ISM elements and ES&H Manual requirements into work documents.

- Establish more defined management expectations through direction in the ES&H Manual on how requirements are to be implemented across line organizations.

- Re-examine crosscutting programs and requirements to determine whether institutional programs or procedures would provide more consistent and effective implementation across the site.

- Consider reformatting the PHSs into a three-column job safety analysis format to enable linkages between a specific task/activity, the hazard from that task, and the specific control that will mitigate that hazard.

- Require workers to perform a documented "mini" job safety analysis for all work to form a final barrier against unsafe work and extend responsibility and accountability for safe work down to the working level.

2. **Enhance the SNL/NM program for performing industrial hygiene exposure assessments to include documenting the results of assessments that do not require exposure monitoring.** Additional actions to consider include:

   - Incorporate the exposure assessment strategy using guidance provided in the DOE Standard for Industrial Hygiene Practices (DOE-STD-6005-2001) and the exposure assessment guidance provided by the American Industrial Hygiene Association.

   - Define how the exposure assessment strategy meets or exceeds similar requirements contained in DOE Order 440.1A.

3. **Develop and implement a work control process for programmatic work activities that addresses how work at the activity level is to be defined and authorized, how hazards are to be analyzed, how controls are to be documented, and how hazard controls are to be linked to specific work hazards.** Specific actions to consider include:

   - Develop instructions for the use, review, and approval of the service work order form, including how work is to be authorized, how hazards are to be analyzed, and how controls are to be documented.

   - Establish a protocol for the development, use, review, and approval of technical work documents to supplement the guidance provided in the ES&H Manual. Define expectations for identifying hazards and controls in technical work documents.

   - Clarify the role of the PHS in the programmatic work control process.

   - Establish guidelines and thresholds for involving ES&H SMEs in the preparation and review of work documents.

- Use AMPL as a pilot for the action items above and then extend implementation to other facilities and activities.

4. **Increase emphasis on formality and rigor in work control processes at RMWMF, including clarity and completeness of hazards and controls as needed to verify and demonstrate personnel understanding as well as compliance with all ES&H requirements.** Specific actions to consider include:

   - Re-evaluate the feasibility of job-specific RWPs that consolidate common controls (such as those on existing general RWPs) and that are supplemented by attachments for container-specific hazards and controls. Alternatively, consider the feasibility of requiring authorized user lists for individual work plans and supplements to ensure proper worker concurrence and feedback regarding radiological controls.

   - Require formal integration or documentation of any special controls, such as the RMWMF RCT bioassay programs within RWPs or other technical work documents, to ensure accurate understanding of the purpose and effectiveness of these controls.

   - Ensure that information contained in subcontractor health and safety plans is required to be reviewed by radiation protection SMEs and that differences from SNL/NM programs are integrated or annotated as appropriate into radiation protection plans and procedures.

   - Institute more rigorous and comprehensive air monitoring programs at RMWMF, including the use of fixed air head or job-specific air samplers with sufficient sensitivity to determine airborne concentrations (e.g., for posting/downposting), especially in areas or operations that rely solely on CAMS for radiological characterization data.

   - Define (e.g., within AOPs or facility operation procedures) a consistent and systematic approach to developing work plans that includes management expectations regarding the format and content of hazard and control information, with a goal of complete, accurate, and defensible work plans as they relate to hazards and associated controls.

   - Examine more closely the accuracy of hazard and control information presented in work plans, including PPE requirements, and encourage workers and management to identify and correct any discrepancies before performing work.

5. **Focus attention on line organization generator waste management activities that could impact the continued success of the waste management program's compliance with Federal, state, and site requirements.** Specific actions to consider include:

   - Attempt to centrally manage and compile accurate information on current amounts of line-owned radioactive waste and material that will likely become waste, and use the information in long-range forecasting and planning for proper radioactive waste management.

   - Institute a more rigorous ISM approach to hazardous waste management in line organizations so that all waste streams are properly characterized and controls (including labeling) are correctly implemented before making disposal requests. Provide additional training to personnel to ensure that expectations are understood.

6. **Ensure that institutional waste management documents are kept current and are sufficiently detailed to address compliance with all applicable requirements.** Specific actions to consider include:

   - Revise the *Radioactive Waste Management Basis for DOE Order 435.1* to include specific requirements of the order that will be met and mitigating actions for requirements that will not be met.

   - Finalize the draft SNL/NM ES&H policy and the draft FY 2003 SNL/NM Pollution Prevention Program Plan.

7. **Improve management and supervisory support for workers involved in maintenance work activities.** Specific actions to consider include:

   - Ensure that work planning evaluates all work and documents the dominant job-specific hazards and mitigating controls on all Maximo work orders.

   - Require work orders to reference the specific PHS, the relevant operating procedure, and other technical information craft need to perform the work.

   - Require all work orders to be taken to the job site and to be available within "easy reach."

   - Have work planners translate customer requests to clear statements of work.

   - Implement a more proactive post-job review process to elicit feedback and improvement from workers.

   - Establish a documented, risk-based system to ensure that readiness to perform work is confirmed with higher levels of approval for higher-risk jobs (e.g., verbal notification to the building manager/building operator for a low-risk job, and signature approval for outages).

   - Consider modifying the Maximo work order form to include a building manager/building operator/facility signature that ensures notification and certification that work area conditions are safe to immediately start work.

   - Require pre-job briefings before the start of any maintenance work job (including work on such facility systems as fire protection). Include the review of the maintenance job plan and maintenance work order to identify abnormal environmental or working conditions and to clarify job scope. Include provisions for discussing hazards and co-located projects.

   - Require post-job briefings at the completion of maintenance work to identify changes in procedures, scope of work, environmental conditions, and required PPE. The post-job briefings can be used to revise time estimates and clarify maintenance job expectations.

8. **Increase efforts to establish and communicate requirements for fire protection service contracts, and clarify SNL/NM management expectations for individuals (owners, project managers, users, and ES&H representatives) who are responsible for monitoring service contractors' compliance and performance with NFPA standards.** Specific actions to consider include:

- Prepare written documents that specifically define monitoring roles, responsibilities, and accountability for fire protection service contracts for designated organizational positions and technical staff.

- Train owners, project managers, users, ES&H representatives, and appropriate technical staff on key maintenance provisions (inspections, testing, preventive and corrective maintenance) of service contracts affiliated with the fire protection systems and program.

- Designate individuals and technical staff to assess service contractors to determine performance and adherence to NFPA requirements for fire protection systems and programs.

9. **Use scheduling and the Maximo system to schedule all NFPA requirements associated with inspections, testing, and maintenance for carbon dioxide, Halon, and automatic sprinkler systems, and other SNL/NM fire protection systems.** Specific actions to consider include:

    - Use Maximo to schedule all fire protection system maintenance and testing to prompt work planners, owners, project managers, users, ES&H representatives, and technical staff to conduct inspections, testing, and preventive maintenance on SNL/NM fire protection systems.

    - Coordinate and identify maintenance windows or shutdowns to schedule inspections, testing, and preventive maintenance of fire protection systems at SNL/NM for the service contractor(s).

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APPENDIX F

Essential System Functionality

F.1 INTRODUCTION

The purpose of an essential systems functionality 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 selected systems. The review criteria are similar to the criteria for the Defense Nuclear Facilities Safety Board Recommendation 2000-2 implementation plan reviews; however, this U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) review also included a review of selected portions of system design.

The OA team selected two systems within the Microelectronics Development Laboratory (MDL), Building 858, for review. The primary focus of the essential system functionality review was the fire protection system. The OA team also reviewed the toxic gas distribution system, focusing on the design of the new specialty gas storage bunker and gas distribution system.

Building 858 is used for semiconductor research and development and consists of two buildings connected by an enclosed breezeway. The South Building consists primarily of light electronic and chemical laboratories and office support areas. The North Building houses the mechanical systems and semiconductor chip fabrication. The semiconductor chip fabrication consists of a variety of photo-etching processes, which use several highly toxic, reactive, and pyrophoric gases.

The fire protection system includes three separate wet pipe sprinkler systems, which protect various portions of the buildings, and a number of Halon and carbon dioxide (CO_2) systems, which are installed on various wet chemistry benches throughout the facility. The fire protection systems have recently been modified to improve seismic resistance and provide greater water flows to support expansion of the facility, and components have been installed to prevent backflow and allow full flow testing.

The toxic gas distribution system is used to supply toxic gases needed in the photo-etching and deposition processes to various machines and laboratories. Currently, the bulk quantities of the toxic gases are stored in a bunker in the basement and in a bottle farm outside the building. In-service bottles are stored in gas bottle cabinets to supply a particular machine or laboratory. The toxic gas distribution system is also undergoing significant modification, including the addition of a new specialty gas storage bunker located outside the facility.

F.2 RESULTS

F.2.1 Design

The MDL fire protection system is well designed in most respects. It has numerous attributes that contribute to its capability and reliability, including a very reliable water supply from Kirtland Air Force Base, which consists of three storage tanks with a combined capacity of 5.3 million gallons, backed up by two high-capacity well pumps.

The recent upgrades to the fire protection system increased its reliability and performance. The supply system water mains were recently upgraded with new, higher-capacity piping, which raised supply

pressure at the MDL approximately 20 pounds per square inch gauge (psig). The design standard for the upgrades increased the margin of safety performance by requiring the system to function as designed even if the supply pressure is 30 percent less than the actual pressure experienced during tests. The recently completed MDL fire protection system upgrade also significantly increased the reliability and degree of protection by increasing sprinkler coverage and density, replacing aging and/or undersized piping, increasing system performance margins, and strengthening the system to meet seismic qualification requirements.

Although the upgraded portions of the fire protection system are designed to ensure reliability and performance, two aspects of the design process and/or documentation do not fully meet applicable requirements. First, the analysis documentation provided by the upgrade contractor is not sufficient to demonstrate that the upgraded portions of the fire protection system meet National Fire Protection Association (NFPA) code hydraulic requirements. Second, the system upgrade did not fully address the NFPA 13 seismic requirements and DOE Order 420.1, Section 4.4.2, which covers natural phenomena mitigation design. These requirements specify that common cause effects and failure of other systems, structures, and components be considered. The system upgrade did not explicitly address the building and co-located components, which were designed to the lower seismic requirements of the 1985 Uniform Building Code. Therefore, the SNL/NM analysis is not sufficient to demonstrate that the upgraded system provides full assurance that it will function after a seismic event. SNL/NM personnel indicated that, in many cases, strict compliance with the DOE Order design provisions for natural phenomena mitigation may be impractical from cost and operational impact perspectives. However, SNL/NM has not requested an exception to the DOE order (as required by the SNL/NM Corporate Fire Protection Program) or formally communicated the issue to Sandia Site Office and National Nuclear Security Administration management. Discussions with SNL/NM fire protection personnel indicate that similar concerns could exist with other capital improvement projects and fire protection systems across the SNL/NM site.

The modification of the toxic gas distribution system in MDL has the potential to reduce both the likelihood and consequences of an explosion or toxic gas release. The new bunker, currently under construction, will significantly increase the safety of the toxic gas distribution system because the toxic and pyrophoric gases will be stored in a separate structure that is specifically designed to the latest applicable codes and standards and is more resistant to such natural disasters such as earthquakes and floods. However, the new system has a number of potential design flaws as described below.

The review of the ventilation system identified several potential design weaknesses. One of the gases that will be stored in the new specialty gas bunker is silane, a pyrophoric gas that presents an explosion hazard and requires mitigation in accordance with NFPA 318. The bunker is provided with ventilation that directs high-volume/high-velocity supply air jets directly onto the storage bottles and distribution manifolds. This mitigation technique reportedly reflects similar schemes used within the semiconductor industry. The airflow is intended to ensure that any leakage would be diluted to a level below the lower explosive limit (LEL) concentration. Without the ventilation, project calculations indicate that a design basis leak could challenge the bunker's design explosion pressure limit in a short time (30 seconds). Therefore, continuous supply fan operation is necessary. However, only one supply fan was installed for the new bunker. No provisions were made to take this fan out of service for routine maintenance, and a failure of the fan—even for a short duration—could leave the bunker unprotected. In addition to the direct explosion hazard, such a failure could also cause release of some of the other highly toxic gases stored in the bunker, such as phosphine.

The design of the silane leak detection system does not adequately consider the presence of the ventilation systems and is not sufficient to detect leaks. Infrared/ultraviolet monitors aimed at the bottles and distribution manifolds provide leak detection for the silane storage and distribution components in the

new bunker. If leakage is detected, these monitors provide a signal to close the affected bottle's fail-safe solenoid isolation valve. These monitors detect leakage by sensing the infrared/ultraviolet radiation given off by burning silane. During normal operation, with the high-volume/high-velocity ventilation air directed onto the bottles and manifolds, the airflows are high enough that the lower flammability limit (LFL) concentration would not be reached (for silane, the LFL is the same concentration as the LEL) and thus a leak would not be detected during normal operations. If the ventilation system fails, an undetected leak could accumulate in potentially explosive concentrations before it could be detected and isolated.

Estimated blast pressures could exceed the bunker design pressure. The new bunker structural design pressure is 215 pounds per square foot (psf). The project calculation for the design basis silane leak explosion indicated a blast pressure of approximately 250 psf. The SNL/NM project engineers have not yet resolved this discrepancy.

Seismic events could result in damage to gas bottles and distribution manifolds. The ventilation components inside the new bunker are located directly above the gas bottles and gas distribution manifolds, and are not adequately supported to ensure that they will not fall in a seismic event. Damage to the gas bottles and manifolds could result in leakage of silane and/or other toxic gases, which could lead to an explosion. Additionally, the balance of this ventilation system was not designed to seismic standards. The current design does not fully meet DOE Order 420.1 requirements, which require systems to be capable of performing their intended safety function after a seismic event, such as earthquake, and consideration of interactions with other safety systems.

SNL/NM did not have adequate analysis to demonstrate that all applicable factors had been adequately addressed in the design of roof blowout panels, which provide explosion overpressure protection for the new specialty gas bunker. The 2000 Factory Mutual Insurance Company standard and NFPA 68, *Guide for Venting Deflagrations*, discuss such factors as snow and ice accumulations, panel weight, and panel relief pressure, but the current SNL/NM design does not adequately address these conditions.

The design of the new specialty gas storage bunker does not consider the effects of a design basis flood on certain critical ventilation power supply components. DOE Standard 1020, *Natural Phenomenon Hazards Design and Evaluation Criteria for Department of Energy Facilities*, Section 4.1.2, "Flood Evaluation Process," requires that facilities be protected from the design basis flood. Most important structures, systems, or components, such as the ventilation supply air fan inside the air handling units, are installed above the flood level and thus are adequately protected. However, several power supply components for the fan, such as its motor control center, are located inside the MDL building below the design basis flood level. These components could fail during a flood and render the ventilation supply air fan inoperable.

In summary, the fire systems reviewed are well designed in most respects and the upgrades enhance their reliability and performance. However, there was insufficient information in retained records, particularly with respect to design calculations, to permit independent verification of the system design capabilities. The ongoing modifications to the new toxic gas distribution system have the potential to enhance safety. However, a number of potential design weaknesses were identified in the new specialty gas bunker for MDL. Because this bunker is not yet operational, the design weaknesses do not currently have a safety impact.

F.2.2 Configuration Management

SNL/NM does not have adequate procedures for ensuring configuration control for two essential systems reviewed during this OA inspection (see Finding #10). Configuration management at SNL/NM primarily relies on the expertise and attention to detail of the individual building managers, engineers, supervisors,

and technicians. Inadequate measures for maintaining configuration control can result in unauthorized modifications to systems or other such actions that could cause the system to fail during normal or emergency operations, and contributed to the technical deficiencies identified by the OA team. In several instances, the validity of design basis calculations could not be verified because supporting information was not adequately managed and controlled. For example, SNL/NM could not decipher supporting documents intended to demonstrate the hydraulic capability of the MDL fire protection upgrade. In addition, critical silane bottle design parameters (the restricting flow orifice size and the maximum bottle pressure) were not translated into procurement specifications and receipt inspection procedures. Vendor-supplied silane bottles are normally delivered to the customer with built-in flow restricting orifices, and the design basis leak used for the bunker design basis explosion calculation assumed that such an orifice was present. However, there were no controls (e.g., procurement or receipt inspections) to ensure the correct orifice size and bottle pressure. Other configuration control deficiencies are discussed in Section F.2.3.

In summary, SNL/NM does not have structured processes to ensure that essential systems are properly configured. The deficiencies in supporting information, controls, and system configuration identified on this OA inspection indicate that the current configuration management processes are not always effective.

F.2.3 Surveillance and Testing

SNL/NM inspection and testing of fire protection systems and alarms complies with most of the nationally accepted standards established by NFPA. Electronic monitoring is used extensively to detect unauthorized movement of fire protection system control valves. Where electronic monitoring is not used, valves are effectively locked. For surveillances that are performed, discrepancies are quickly repaired, and systems are returned to full service in a timely manner. Technicians performing the surveillances are knowledgeable about the installed equipment.

However, the SNL/NM inspection and testing program is deficient in a number of areas as discussed in the remainder of this subsection. Some of these deficiencies are recurring, and several result from inadequate attention to detail, inadequate procedures, insufficient management and supervisory controls, and inadequate configuration control measures. (See Finding #10.)

The rigor of the management and supervisory systems for inspection and testing does not ensure that some requirements of the applicable codes and standards are met. NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, establishes very specific requirements for the type of inspections that must be performed, their frequency, and record keeping. SNL/NM has a matrix schedule for the necessary inspections, but procedures for performing the inspections have not been implemented or are inadequate. SNL/NM relies primarily on the individual sprinkler technician's knowledge to determine whether the inspected element is adequate. Although inspection procedures are not specifically required by the NFPA code, SNL/NM has not established effective methods to ensure that the correct test sequences are performed and that the results are acceptable. Supervisory review of the inspection records is weak, as evidenced by the many cases of unsigned or undated records and clearly incorrect or discrepant results that were not noted or investigated. For example, during the March 2002 monthly inspection for Building 858, the recorded pressures in certain rooms clearly indicated a discrepancy, because the pressure above the valve was lower than the pressure below the valve. By design, the pressure above the valve must be higher or equal to the pressure below the valve, yet no indication of a problem was entered on the inspection data sheet. Most records for 2002 did not include the inspector's name or actual date of the inspection, even though NFPA 25 requires that both pieces of information be recorded and retained.

Inadequate supervisory review of inspection and testing is also indicated by the failure, in many cases, to perform the quarterly inspections for Building 858. None were performed from November 2001 to November of 2002, and over the past two years, the quarterly inspection has been missed more times than it has been performed. NFPA 25, Section 4.5.3, requires that test results be compared with those of the original acceptance test (if available) and with the most recent test results. There was no indication that this comparison is taking place on a regular basis. The original acceptance testing data for the fire protection system was not available and has not been used to evaluate current inspection and test results. The personnel responsible for evaluating the data were not aware that this requirement existed, and were unaware of any of the record keeping discrepancies.

The lack of a detailed, systematic configuration management/change control process contributed to the failure to perform some required inspections and tests of the fire protection system. For example, technicians perform tests and inspections of the fire alarms for the various alarm zones. Last year, the alarms for Building 858 were modified to report through a different part of the system, and thus a different alarm zone. The change process did not include modification of the inspection test record sheets or procedures. Consequently, the technicians did not perform the tests on one zone for several months.

During an OA walkdown of a quarterly inspection test with a sprinkler technician, an orifice was determined to be missing from the inspectors test connection for riser number 3. The orifice simulates flow from the most remote sprinkler head and is critical for verifying that the flow alarms in the system will sound within the specified time. NFPA 25 requires the flow alarm to sound within five minutes of opening the valve. Removal of the orifice significantly changes the flow rates and thus negates the validity of the test. It was later determined that the missing orifice had been removed approximately three weeks earlier to attach a hose to the system while draining a portion of the system for maintenance. The hose was installed to prevent water from pooling and freezing on a nearby walking surface. The potential safety problem was not identified during the planning process, but was addressed at the time of work. There were no steps in the work plan for removing the orifice, or ensuring that the orifice was replaced when work was complete. The job plan for the quarterly test does not include provisions for ensuring the orifice is installed, and the sprinkler technician indicated that technicians do not normally verify that the orifice is installed. Consequently, there is no assurance that the discrepancy would have been noticed on future tests and the test results would have produced inaccurate and non-conservative results.

SNL/NM has not implemented some NFPA 72, *National Fire Alarm Code*, requirements. For example, a semiannual preventive maintenance provides a test of the alarm and includes actuation of various detectors throughout the facility. The alarm check includes a battery test of the installed sealed lead acid battery. NFPA 72, Chapter 10, specifically requires a semiannual load voltage test of the installed sealed lead acid battery. The battery test performed by SNL/NM technicians does not meet the specifications of NFPA 72, because it does not compare battery performance with manufacturer's specifications while under load. Technicians performing the test are not aware of NFPA 72 performance requirements, and the requirements are not provided in the job plan. In addition, there is no indication that SNL/NM performs the annual 30-minute discharge test on sealed lead acid batteries installed in fire alarm systems, as required by NFPA 72. Further, SNL/NM had never performed checks of smoke detector sensitivity with a calibrated smoke test, as required by NFPA 72.

In summary, most of the monthly, quarterly, and semiannual inspections and tests of the fire protection system are performed. However, several important inspections and tests required by NFPA codes are not performed, reducing the assurance that the system will reliably perform as intended during a fire. Multiple problems were identified with respect to NFPA 25 and NFPA 72 requirements, including inadequate record keeping, failure to perform required tests, and failure to ensure that tests met the requirements of the standards. Few procedures are available for the performance of these inspections. Instead, SNL/ML relies on skill of the craft.

F.2.4 Maintenance

Based on observations during several systems walkdowns, the CO_2, Halon, and wet automatic sprinkler fire protection systems in MDL were in good material and physical condition. The areas and components observed were clean, with no visible leaks or corrosion and no excessive pitting, dents, or cracks.

Members of the SNL/NM facilities management team were responsive to identifying and replacing recalled sprinkler heads, and received a Sandia Employee Recognition award for their efforts. During the worldwide recall of "Omega" sprinkler heads, maintenance personnel and fire protection engineers coordinated their efforts to install replacements, which minimized impact on operations.

Maintenance managers, supervisors, and technical staff (fire protection sprinkler fitters, fire protection technologists, and engineers) have good qualifications and training. Maintenance personnel who work on the MDL fire protection systems are routinely sent to offsite fire protection training courses. For example, fire protection sprinkler fitters attend a formal course on how to maintain the wet automatic sprinkler system.

However, the defined preventive maintenance of the MDL wet automatic sprinkler system was not in full compliance with NFPA Standard 25. For example, the annual maintenance inspection of the number, type, model, size, and manufacturer of on-hand spare sprinklers and wrenches (NFPA Standard 25, 5.2.1.3) is not conducted. Inspection of the maintenance shop sprinkler cabinet revealed that sprinkler wrenches were not available for each type and temperature-rated sprinkler installed. Checks of three fire protection sprinkler fitter's maintenance utility trucks determined that spare sprinkler wrenches were on the trucks and thus were stored separately from the spare sprinklers in the cabinet. Also, no records were available to verify that gauges for the wet automatic sprinkler system were being replaced or checked against a calibrated gauge every five years, as prescribed in NFPA 25, Section 5.3.2.

Detailed procedures are not developed or used for corrective and preventive maintenance of MDL fire protection systems. Instead, SNL/NM relies on individual craft expertise (skill of the craft) to ensure proper installation, repair, and modification of systems, components, and equipment. Fire protection maintenance job plans (maintenance work packages) and maintenance work orders often lacked detail, especially with regard to such technical source documents as industry standards, vendors' manuals, and DOE requirements. Maintenance job plans and work orders prepared by the planner, from the Maximo maintenance software program, often lacked manufacturers' procedures or vendors' step-by-step guidance to perform required preventive and corrective maintenance. All three fire protection sprinkler fitters who were interviewed indicated that they preferred having detailed procedures or step-by-step guidance attached to the maintenance job plan or work order. One sprinkler fitter indicated that he used manufacturers' procedures and vendors' step-by-step guidance for the repair and tear down of components and equipment in the wet automatic sprinkler system because detailed procedures and guidance are rarely provided with assigned fire protection maintenance work. As discussed above, a maintenance activity that was performed without detailed procedures resulted in a failure to replace an orifice that was critical to the accuracy of a required test.

Periodic inspection, testing, and maintenance of user-installed Halon and CO_2 systems in MDL are not being performed on a consistent basis, as required by NFPA Standards 12, 12A, 12B, and 72. Available records indicate that periodic (weekly, monthly, semiannual, annual, and twelve-year hydrostatic test) preventive maintenance of the CO_2 fire protection systems was rarely performed in MDL. Many members of the SNL/NM Fire Protection Group and the users of the CO_2 systems were not aware that the fire protection service subcontractor was required under the statement of work in the contract to perform and comply with all inspections, maintenance, and testing as specified under the latest edition of NFPA

standards. A review of subcontractor records (e.g., suppression system inspection/check-off reports) for the past three years indicated there were no documented preventive maintenances, tests, or inspections conducted on the CO_2 systems. The Fire Protection Group was not specifically assigned responsibility to track completion of inspections, tests, or maintenance on these user-installed systems, and the users did not demonstrate an awareness of the NFPA requirements.

A review of records also indicated that periodic (monthly, semiannual, annual, and five-year hydrostatic test) preventive maintenance, inspections, and tests of the Halon 1301 and 1211 fire extinguishing systems were rarely conducted in MDL. A review of the SNL/NM and subcontractor maintenance records indicate that only two semiannual inspections were performed on the Halon 1301 and 1211 fire extinguishing systems in the past three years, and no monthly, annual, and/or five-year hydrostatic tests were performed on these systems.

Historical files for the CO_2, Halon, and wet automatic sprinkler fire protection systems were limited and not always maintained. Some historical files for the automatic sprinkler system were maintained by the maintenance supervisor and the fire protection planner/analyst. A comparison of components in the MDL automatic sprinkler system validated that the historical maintenance source documents (in room 1326A of Building 887) such as vendor manuals, industry standards, and technical pamphlets, are reflective of installed systems, components, and equipment. However, the system owners and users of the Halon 1301 and 1211 fire extinguishing systems had little or no documentation for their systems. The maintenance supervisor and fire protection planner/analyst indicated that the Maximo system did not retain the history of the CO_2, Halon, and wet automatic sprinkler system components and equipment to allow tracking and trending of maintenance actions. There was no written procedure describing how maintenance job plans and work orders are permanently stored or archived.

Maintenance source documents, such as DOE orders and applicable requirements/standards, are rarely used as the bases for developing maintenance job plans or work orders. The fire protection planner/analyst often does not use maintenance source documents when ordering systems, equipment, components, and parts for the MDL fire protection systems. An inventory listing of such items as pressure gauges was not readily available. Also, there are no written, detailed procedures on how to order required replacement systems, equipment, components, and parts.

In summary, fire protection systems are in good material condition, and personnel who work on the systems are well qualified and trained. However, maintenance procedures for MDL fire protection systems are inadequate. Many scheduled preventive maintenances on the MDL fire protection systems are not being performed as required, which could contribute to the failure of the systems to operate when needed and costly repairs. Lack of detailed maintenance procedures and step-by-step guidelines have negatively affected completion of maintenance tasks and can contribute to reduced system reliability.

F.3 CONCLUSIONS

The overall material condition of the fire protection systems appears adequate, and the recent upgrades enhance system reliability and performance. However, the applicable DOE requirements and NFPA codes and standards are not fully met in a number of cases. Further, procedures and records are weak in most areas reviewed. Although these deficiencies do not represent an immediate concern that would prevent the fire protection and alarm systems from performing as designed in the event of a fire, several elements of the SNL/NM fire protection program (inspections, surveillance, testing, maintenance, and configuration management) are not sufficiently rigorous and effective. As a result, the current SNL/NM fire protection program does not provide the level of assurance required by DOE orders and national standards that the systems will operate reliably.

The ongoing modifications to the new toxic gas distribution system have the potential to enhance safety. The identified potential design weaknesses in the new specialty gas storage bunker for MDL do not currently have a safety impact because the bunker is not operational. However, they indicate a need for more effective design reviews and quality assurance processes.

Although the scope of this OA inspection is limited to the selected systems, some aspects of the identified deficiencies may be a sitewide concern that could affect other SNL/NM facilities, including higher-hazard facilities. Because responsibility for many aspects of the fire protection systems rests with a centralized group or subcontractor, it is likely that similar problems (e.g., failure to perform required inspections) extend across the entire SNL/NM site.

Finding #10. SNL/NM has not established rigorous management and supervisory processes or systems that ensure that essential systems are designed and maintained in accordance with applicable codes, standards, and DOE orders, leading to a potential reduction in the reliability of SNL/NM essential systems.

F.4 RATINGS

Design .....NEEDS IMPROVEMENT
Configuration Management .....NEEDS IMPROVEMENT
Surveillance and Testing .....NEEDS IMPROVEMENT
Maintenance.....NEEDS IMPROVEMENT

F.5 OPPORTUNITIES FOR IMPROVEMENT

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

SNL/NM

1. **Develop and implement a more detailed design and configuration management process that is clearly documented and includes procedures that delineate responsibilities and expectations.** Specific actions to consider include:

   - Develop and document engineering procedures that define responsibilities and processes for generating, reviewing, and approving new and modified designs.

   - Develop and document procedures that define expectations for engineering organizations and establish and describe the standard interfaces and responsibilities between these organizations and those other technical organizations that also have responsibilities in configuration management, such as Maintenance, Operations, and Surveillance and Testing, to ensure that the design intent is properly and adequately translated into these other organizations' procedures and processes that have the potential to affect the configuration of safety structures, systems, and components.

- Develop and document procedures that address all of the standard technical output products of these organizations, such as drawings, specifications, calculations, design studies, and technical qualitative analyses, and establish the requirements for these documents with respect to content and format; identification, storage, and retention; and all other necessary attributes and processes for the production of high-quality products and outcomes.

- Develop and implement effective configuration management for critical design parameters to include formal communications from the engineering organization to the user organization of the requirement to control these parameters, and the development of these formal procedural controls by the user organization. Such controls should typically include procurement documents specifying the parameter limits, and materials receipt procedures requiring verification of these parameters.

2. **Complete a baseline needs analysis that documents resource requirements to complete all inspections, tests, and maintenance required by codes and standards for the fire protection system.** Items to consider in such a baseline include:

   - Review records and record retention.

   - Compare current test methods to code requirements.

   - Compare the current frequency of testing and inspection to code requirements.

   - Identify new resources that are necessary to meet code requirements.

   - Document equivalence to the standards where appropriate.

   - Ensure justification and acceptance by the authority having jurisdiction for any exemptions to the codes.

   - Ensure management acceptance of responsibility for providing the necessary resources, or management acceptance of additional risk.

3. **Clearly establish and communicate requirements for fire protection service contracts, and clarify SNL/NM management expectations for those positions (owners, project managers, users, and ES&H representatives) having responsibility for monitoring service contractors' compliance and performance with NFPA standards.** Specific actions to consider include:

   - Prepare written policies and procedures that specifically define oversight and monitoring roles, responsibilities, and accountability for fire protection service contracts for designated organizational positions and technical staff.

   - Train owners, project managers, users, ES&H representatives, and other technical staff on key maintenance provisions (inspections, testing, preventive and corrective maintenance) of service contracts affiliated with the SNL/NM fire protection systems and program.

   - Designate individuals and technical staff to conduct spot reviews of service contractors to determine performance and adherence to NFPA requirements for SNL/NM fire protection systems.

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