Independent Oversight Inspection of Environment, Safety, and Health Programs at the

Sandia National Laboratories

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Abbreviations Used in This Report

ACRR	*Annular Core Research Reactor*
ACRRF	*Annular Core Research Reactor Facility*
CFR	*Code of Federal Regulations*
DOE	*U.S. Department of Energy*
DSA	*Documented Safety Analysis*
ES&H	*Environment, Safety, and Health*
ESH&QA	*SSO Office of Environment, Safety, Health and Quality Assurance*
FEOSH	*Federal Employee Occupational Safety and Health*
FMOC	*Facilities Management and Operations Center*
FREC	*ACRR Fuel-Ringed External Cavity*
GIF	*Gamma Irradiation Facility*
HSS	*DOE Office of Health, Safety and Security*
HWMF	*Hazardous Waste Management Facility*
ILMS	*Integrated Laboratory Management System*
ISM	*Integrated Safety Management*
NFPA	*National Fire Protection Association*
NNSA	*National Nuclear Security Administration*
OSHA	*Occupational Safety and Health Administration*
R&D	*Research and Development*
RMWMF	*Radioactive and Mixed Waste Management Facility*
RWNMDD	*Regulated Waste/Nuclear Material Disposition Department*
SAC	*Specific Administrative Control*
SME	*Subject Matter Expert*
SNL	*Sandia National Laboratories*
SSO	*Sandia Site Office*
SSOE	*Safety System Oversight and Engineering*
TSR	*Technical Safety Requirement*
USQ	*Unreviewed Safety Question*

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1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight, within the Office of Health, Safety and Security (HSS), inspected environment, safety, and health (ES&H) programs at the DOE Sandia Site Office (SSO) and Sandia National Laboratories (SNL) during January and February 2008. HSS reports directly to the Secretary of Energy, and the ES&H inspection was performed by Independent Oversight's Office of Environment, Safety and Health Evaluations.

Within DOE, the National Nuclear Security Administration (NNSA) has line management responsibility for SNL. NNSA provides programmatic direction and funding for research and development (R&D), facility infrastructure activities, and ES&H implementation at SNL. At the site level, line management responsibility for SNL operations falls under the SSO Manager. Under contract to DOE/NNSA, SNL is managed and operated by Lockheed Martin Corporation.

SNL's primary mission is to provide scientific and technology support to U.S. national security programs. SNL focuses on developing technologies to sustain, modernize, and protect the U.S. nuclear arsenal; prevent the spread of weapons of mass destruction; defend against terrorism; protect the national infrastructure; ensure stable energy and water supplies; and provide new capabilities to U.S. armed forces. SNL also performs R&D and science, technology, and engineering programs in a wide variety of areas (e.g., bioscience, computing, materials, and physics).

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

MicroFab Facility at SNL

The purpose of this Independent Oversight inspection was to assess the effectiveness of ES&H programs at SNL as implemented by Lockheed Martin under the direction of SSO and NNSA. Independent Oversight evaluated a sample of activities at the SNL site in Albuquerque, New Mexico, including:

- Implementation of the core functions of integrated safety management (ISM) for selected SNL facilities and activities, focusing on work planning and control systems at the activity and facility levels. The Independent Oversight inspection selectively evaluated:

  - Work activities in the Microsystems Science, Technology & Components facilities, focusing on selected work activities performed in the "heavy" labs (including MicroFab and SiFab) and "light" labs

  - Neutron generator production activities and supporting operations, focusing on selected work activities performed by the Responsive Neutron Generator Product Deployment Center (Center 2700)

  - Facility Operations work activities in the Hazardous Waste Management Facility (HWMF) and the Radioactive and Mixed Waste Management Facility (RMWMF), focusing on selected operations work performed by the ES&H and Emergency Management Center

  - Facility maintenance performed by the SNL Facilities Management and Operations Center (FMOC), focusing on, but not limited to, selected maintenance work activities performed for Microsystems Science, Technology & Components facilities and the Explosive Component Facility

  - Construction performed by subcontractors under the direction of the FMOC.

- Essential system functionality for selected safety systems at the Annular Core Research Reactor (ACRR) at the ACRR facility (ACRRF). Selected systems included the reactivity control system, reactor coolant system, and associated design features and instrumentation and controls. The Independent Oversight team also performed a limited review of the status of selected corrective actions for essential system functionality weaknesses identified for the ACRRF and the Gamma Irradiation Facility (GIF) during the 2005 Independent Oversight ES&H inspection. In addition, Independent Oversight evaluated the SNL cognizant system engineer program and the SSO safety system oversight and engineering (SSOE) program.

- SSO's and SNL's effectiveness in managing and implementing selected aspects of the ES&H program that Independent Oversight has identified as focus areas, including hazardous chemical management, waste management, specific administrative controls (SACs) for nuclear facilities, and injury and illness reporting. Although these topics are not individually rated, the results of focus-area reviews are integrated with or considered in the evaluation of other ISM elements. In examining these areas, Independent Oversight focused primarily on the application of institutional programs to SNL at the activity and facility levels.

- SSO and SNL feedback and continuous improvement systems, with a focus on their application to SNL facilities and activities that were evaluated during this Independent Oversight inspection. The review of feedback and improvement systems also constitutes the Independent Oversight evaluation of the effectiveness of SNL's and SSO's implementation of DOE Order 226.1A, Implementation of DOE Oversight Policy, which is a long-term Independent Oversight focus area. NNSA oversight was not reviewed in this 2008 Independent Oversight inspection because NNSA had been evaluated as part of a recent (December 2007) Independent Oversight inspection, and NNSA was still in the process of developing corrective actions in response to the Independent Oversight inspection and an internal NNSA assessment that identified a number of deficiencies.

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

Appendix B presents the findings identified during this Independent Oversight inspection. In accordance with DOE Order 470.2B, *Independent Oversight and Performance Assurance Program*, NNSA must develop a corrective action plan to address each of the findings identified in Appendix B. In most cases, the findings listed in Appendix B were derived from multiple individual deficiencies that are described in the detailed results provided to the site in a separate document. NNSA, SSO, and SNL need to ensure that the corrective action plan for the Appendix B findings addresses these individual deficiencies and includes appropriate causal analyses, corrective actions, and recurrence controls. The findings are referenced in Sections 3 and 4 of this report. The weaknesses in Section 3 provide a management-level summary of the findings; these weaknesses do not need to be separately addressed in the NNSA corrective action plan because the findings encompass the scope of the weaknesses.

2 Positive Attributes

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

The SNL Industrial Hygiene Department completed an ambitious project to provide baseline exposure assessments of all principal work areas within SNL. This occupational exposure assessment process evaluated all SNL work areas with the potential to expose workers to chemical, biological, or ergonomic hazards from January 2006 through September 2007. The project was initiated in response to the SNL corrective actions resulting from the 2005 Independent Oversight finding regarding the lack of a comprehensive exposure assessment program. The occupational exposure assessment process was designed and systematically implemented by the SNL Industrial Hygiene Department and contractor support with oversight provided by SSO. The occupational exposure assessment strategy was modeled after the American Industrial Hygiene Association Exposure Strategy Guide thereby following the expectations of both DOE Order 440.1A and 10 Code of Federal Regulations (CFR) 851 for performing industrial hygiene baseline exposure assessments. Implementation resulted in the performance of over 900 baseline exposure assessment reports.

Engineering controls in the Microsystems Science, Technology & Components Center "heavy" and "light" labs (see Section 4.1) are robust and state-of-the-art. Buildings 858 EL and 858 EF were completed within the past two years and were constructed with state-of-the-art engineering controls for hazardous chemicals and gases. Chemical fume hood controls include continuous pressure and face velocity measurements, and alarms occur if the hood sash is set at a height at which the required flow velocity is not met. Suites of laboratories are designed around a central chase. The toxic gases, liquid nitrogen system, and emergency chemical equipment (e.g., eyewashes) are housed within the central chase. The area is also continuously monitored for hazardous gases and oxygen level. Use of the central chase minimizes the need to house toxic gas cylinders or liquid nitrogen within the individual labs. Access controls ensure only individuals who have completed the necessary training can access most labs. In addition, the toxic gas monitoring system, specialized gas distribution system (including sensors, alarms, and shutoff mechanisms), and storage necessary to manage a moderate hazard design facility are well designed and effectively implemented.

Elements of work planning and control processes have been effectively implemented and/or improved in a number of SNL facilities and organizations. The RMWMF, within the Regulated Waste/Nuclear Material Disposition Department (RWNMDD), has implemented a rigorous process for hands-on waste sorting and treatment that effectively analyzes hazards and clearly conveys controls and detailed work instructions for processing specific waste containers. The level of rigor applied to these processes and the resulting specificity of hazard analysis and controls are notable. Effective ISM implementation is also evident at the Responsive Neutron Generator Product Deployment Center, where management has adopted

a state-of-the-art manufacturing work control process and has effectively integrated activity-level hazard analysis and control while maintaining production needs. This success results from ES&H staff integration, extensive worker involvement, and effective use of technical work documents to rigorously and effectively control task-level activities and associated hazards. The extensive use of pictures and the inclusion of explanatory notes to supplement the action steps in some of the technical work documents has proved to be a particularly good practice. (The notes are stored as hidden text in the word processing program to keep the verbiage of the action steps at a minimum while providing amplifying information if needed at each step.) Construction work control programs and SNL's monitoring and review of subcontractor safety and health programs have been strengthened since 2005 through such measures as adding a requirement for pre-task hazard analyses to construction contracts, using pre-task hazard analyses to remind workers of hazards and controls associated with their assigned tasks, strengthening analysis and control of health hazards through frequent safety professional review, and increasing the use of industrial hygienists. Two recent initiatives by SNL to better control exposures to health hazards are particularly noteworthy because of their benefits to construction subcontractors that do not always have the expertise needed to identify and analyze health hazards. The first initiative is a Welding, Cutting, and Brazing Control Permit that contains exposure controls based upon exposure assessments conducted by the SNL industrial hygiene staff. Controls specified by these permits reduce the potential for exposures to fumes containing hazardous materials, such as lead, chromium, zinc, beryllium, and phosgene gas. The second initiative is the development of a library of exposure hazards and controls for commonly performed construction activities (scheduled for full implementation in April 2008) that will be used to communicate SNL expectations for controlling exposure hazards to prospective subcontractors and improve contract-specific safety plans. The commitment of senior SNL management, including the Laboratory Director, to improving safety is evident. This commitment is demonstrated by their routine surveillances of worksites to determine whether management expectations for work control are understood and implemented at the working level.

The SNL hazardous waste management program's institutional controls, deployed Environmental Compliance Coordinators, and well-operated central waste management facilities effectively support compliance with regulatory requirements. The institutional controls include a comprehensive chapter on hazardous waste in the ES&H Manual and generator-specific training; these have been incorporated into requirements in line technical work documents. Environmental Compliance Coordinators effectively assist and support line organizations in complying with hazardous waste management requirements by providing guidance to generators and assisting in the operations of line organizations' waste management facilities. The SNL centralized waste management facilities continue to effectively manage hazardous waste within regulatory requirements. SNL's Waste Information Management System effectively tracks waste and also allows line generators to characterize waste during the work planning and control process.

Aerial View of Technical Area V

SNL has substantially improved its safety basis processes and documentation for nuclear facilities at Technical Area V. Since the 2005 Independent Oversight inspection, SNL has completed the safety basis improvement project, which has resulted in notable improvements in its safety basis processes, including the safety basis development methodologies and procedures, the unreviewed safety question (USQ) procedures,

and the safety basis training and qualification program. The two active Technical Area V nuclear facilities – the ACRRF and the GIF – have substantially improved their safety bases to meet the requirements of 10 CFR 830 Subpart B. The revised safety basis for ACRRF was implemented in November 2007. The independent verification of readiness of GIF's revised safety bases began in December 2007, and is anticipated to be complete in early 2008. The additional analyses supporting the revised safety bases for the two nuclear facilities were an important aspect of the SNL effort to address the essential system functionality findings and issues from the 2005 Independent Oversight inspection.

ACRRF Reactor Operators are very experienced, well trained, and knowledgeable about operations, maintenance, and testing. The program for training and certifying ACRRF Reactor Operators and Supervisors is well implemented. Additionally, the ACRRF operations staff consists of a relatively small group of Operators. Some of the Operators are also trained and qualified as cognizant system engineers and perform maintenance and testing on all safety-significant and most supporting equipment. Therefore, the Operators possess a high degree of knowledge of equipment design, maintenance, installation, and testing in addition to knowledge of operations.

The Integrated Laboratory Management System (ILMS) provides the framework for a comprehensive and effective management tool for conducting contractor assurance and driving continuous improvement in ES&H programs and performance. Although not fully implemented, the ILMS is composed of cycles of activities for ensuring effective achievement of mission success and operational excellence. An essential element of ILMS is the cyclic process to "assure, assess, and improve," which addresses risk analysis; planning and performance of assessments; implementation of corrective actions and issues management; benchmarking; performance metrics; data analysis; identification of lessons learned; and periodic management reviews of strategy, operations, and overall performance. At the time of this inspection, the ILMS was being applied down to the division and policy-area levels, and SNL was in the final stages of the first cycle of performing the annual management reviews. When fully developed and rigorously implemented down to the "work floor" level, this management system has the potential to aid SNL management in ensuring that safety programs are adequate and implemented as required and expected, and that improvements in processes and performance are continuously identified and applied.

SSO has established the foundation for an effective oversight program and has effectively implemented many important elements. During the 2005 Independent Oversight inspection, SSO's oversight program was ineffective in many areas, and important programs either did not exist or were ineffective. Since then, SSO has focused on building the foundation for a systematic oversight program and made significant progress in strengthening its oversight processes. Staff capabilities have been strengthened by increased senior SSO management's coaching and development of staff. The SSO Facility Representative program has been strengthened by standardization efforts and the recent emphasis on training of Facility Representatives. The safety system oversight and engineering (SSOE) program has been significantly improved. SSO has also made substantial progress in establishing and effectively implementing important internal processes such as the technical qualification program, the operating experience/lessons learned program, and the Federal Employee Occupational Safety and Health (FEOSH) program. For example, the SSO FEOSH program is robust (e.g., frequent workspace walkthrough and good employee awareness) and includes an excellent, user-friendly FEOSH web page that provides added visibility to the program.

3 Weaknesses

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

Although some SNL organizations have established effective work planning and control processes and progress has been made since the 2005 Independent Oversight inspection, process and implementation deficiencies are still evident in several of the organizations that were evaluated. Due to the diversity of laboratory activities, SNL's approach for establishing work planning and control processes has been to establish institutional requirements and rely on numerous organizations to develop individual processes that best meet their needs. For the sample of organizations evaluated during this inspection, the result was mixed; some organizations have established effective processes, while others have not. Some organizations do not have a defined work control process, while others rely upon mechanisms that are not adequate to communicate hazards and controls to workers. SNL's efforts to establish work planning and control processes have not been effective in ensuring that the requirements are always understood and effectively implemented. (See Findings #C-1, C-2, C-3, and C-4.)

The ACRRF safety basis does not correctly identify the bounding parameter for the FREC II fuel cladding thermal-hydraulic/structural analyses and has a potentially significant non-conservatism. The documented safety analysis (DSA) bounding case thermal-hydraulic/structural analyses of ACRR Fuel-Ringed External Cavity (FREC) II fuel cladding incorrectly identifies the bounding parameter as the cladding's ultimate tensile strength, whereas the actual bounding parameter is minimum critical heat flux ratio, and they do not adequately address the loads and resultant stresses imposed on the cladding due to differential expansion of the fuel and the cladding. A proper consideration of the additional stresses could reduce the margins and lower the bounding case reactor power value. (See Finding #E-1.)

SSO and SNL have not ensured timely implementation of DOE requirements for configuration management, the cognizant system engineer program, and safety software quality assurance for nuclear facilities. Full implementation of DOE Order 420.1B, which requires configuration management and the cognizant system engineer program, and DOE Order 414.1C, which requires safety software quality assurance, has been significantly delayed, and the completion dates remain undefined. Although progress has been made, the cognizant system engineer program is not mature and requires significant effort for full implementation: system design description documents have still not been finalized and approved; many documented system walkdowns do not assess system operability, reliability, and material condition; and formal system performance monitoring and trending has not started. The configuration management implementation plan has a number of gaps and weaknesses, and compensatory measures generally are lacking. The full implementation of safety software quality assurance, including defining and applying appropriate software

standards at Technical Area V nuclear facilities, is not yet formalized into a plan and schedule. Thus, the development and implementation of configuration management, the cognizant system engineer program, and software quality assurance implementation plans have been inadequate. (See Findings #E-2, E-3, and E-6.)

Collectively, a number of diverse deficiencies in the conduct of operations, maintenance and surveillance testing indicate a need to improve rigor and formality in nuclear facility safety management. A number of deficiencies were identified in implementing the requirements of the Maintenance Implementation Plan, the Conduct of Operations Manual, and the Sandia Nuclear Facility Operations Quality Assurance Program Plan. These deficiencies are partly attributable to an informal approach to some operations, surveillance, and maintenance activities. The Technical Area V processes for identification, resolution, and tracking of engineering, maintenance, and operational problems and concerns are fragmented and inconsistent. Independent Oversight identified multiple instances where ACRRF and GIF equipment deficiencies and problems had not been appropriately identified, tracked or cleared from established corrective action systems, as required. (See Findings #E-4 and E-5.)

Although progress has been made since the 2005 Independent Oversight inspection, SSO and SNL have not fully developed and rigorously implemented fully effective feedback and improvement processes. SNL's establishment of a fully effective assurance system and full resolution of findings from the previous Independent Oversight inspections have been hindered by deficiencies in execution in three key areas. First, SNL's analysis of the causes of the identified assurance system deficiencies was not sufficiently rigorous, resulting in incomplete corrective action plans that provided insufficient recurrence controls. Second, SNL has not adequately developed and communicated requirements for its contractor assurance program. For example, new institutional process requirements documents were not sufficiently comprehensive, and requirements and procedures were distributed among numerous types of documents and web sites, many with undefined authority and lacking in formal document management controls, contrary to SNL requirements. Third, the focus of corrective actions has been on process improvement, with insufficient attention to the adequacy of implementation and the quality of the outputs of improved processes. As a result of these factors, line and support organizations have not implemented assurance systems in a sufficiently rigorous, compliant, or effective manner (e.g., few formal self-assessments of functional areas adequately evaluate work activities and safety process implementation). In addition, some SSO oversight program elements are not yet sufficiently mature and/or fully functional, including systems-based assessments of SNL, corrective action management, and SSO self-assessments. For example, SSO performs some adequate assessments of SNL ES&H programs but has not systematically established an adequate ES&H and quality assurance baseline oversight program for nuclear facilities as required. SSO has not fully defined processes for systems-based oversight or adequately formalized expectations for oversight of the contractor assurance system. In addition, SSO's transition to a systems-level oversight approach was based on an analysis that did not adequately consider the adequacy of SNL's implementation of its contractor assurance system and therefore was premature, because a systems-level oversight program is predicated on the existence of an effective SNL contractor assurance system. (See Findings #D-1, D-2, D-3, and D-4.)

4 Results

The following sections provide a summary assessment of the SSO and SNL activities that Independent Oversight evaluated during this inspection.

4.1 Work Planning and Control Processes

The Independent Oversight review of work planning and control processes focused on review of the adequacy and implementation of institutional expectations and requirements for activity-level work planning and control.

This 2008 Independent Oversight inspection determined that SNL has made progress in expanding and improving institutional requirements in a number of areas. Some SNL organizations/facilities, particularly those that are production-oriented and work in accordance with detailed procedures (e.g., the Responsive Neutron Generator Product Deployment Center), have effectively implemented work planning and control systems. Other organizations, however, have weaknesses in various aspects of work planning and control, and some of the evaluated organizations have not defined adequate processes to integrate the various tools and techniques into a comprehensive work control process. (See Finding #C-1.)

SNL has not been effective in correcting the 2005 work planning and control finding and ensuring effective ES&H performance across the diverse organizations at SNL. Almost three years after the 2005 inspection, some SNL organizational elements have not defined a comprehensive work planning and control process, and many organizations have multiple weaknesses in various elements of their work planning and control process. In addition, the institutional direction and assessments have not been sufficient to ensure that implementation of ES&H requirements by the various SNL organizations is adequately evaluated and that performance deficiencies are identified and addressed. Further, some organizations have not fully understood or adequately implemented the SNL institutional expectations for having an effective work planning and control process. Finally, although SNL has developed a number of tools as elements of a work planning and control process, the intent of these tools has been misunderstood in many cases, resulting in misapplication and failures in the identification of hazards and controls at the activity level. (See Finding #C-1.)

R&D at Microsystems Science, Technology & Components Center

The Microsystems Science, Technology & Components Center (referred to as 858 Complex or Center 1700) provides the essential facilities and equipment to design, develop, manufacture, integrate, and qualify microsystems for the nation's national security needs. During this inspection, the Independent Oversight Team reviewed both (1) Microsystems Science, Technology & Components Center wafer fabrication

processing facilities (referred to as the heavy labs) and (2) a sampling of electrical, laser and chemical labs that support these production processes (referred to the light labs). Work activities that were reviewed were located within Buildings 858EL, 858EF, 858S, and 858N. Hazards were diverse and included toxic gases, hazardous chemicals, lasers, pressurized systems, biological hazards, and a range of physical hazards.

Within the Microsystems Science, Technology & Components Center, there is a wide diversity of work and mechanisms for defining work activities. In general, although documented processes are lacking in many light labs, most work is well defined, particularly in the heavy production labs and for production-like work in the light labs.

In the light and heavy labs, there are a number of mechanisms for identifying and analyzing hazards. Within the heavy labs, hazards are well defined and analyzed through the safety assessment process, the hazard and barrier analysis process, and the task-level hazard analysis that accompanies the operating procedures. Within the light labs, many hazards are adequately identified and analyzed by various mechanisms, such as process hazard analyses and occupational exposure assessments; however, without a work control process to link these mechanisms, the overall hazard analysis process in the light labs is not always effective. At the task or activity level for the light labs, hazards are sometimes not sufficiently identified or analyzed by these mechanisms so that workers can readily identify the appropriate control. An activity-level hazard control process is not well described in most light lab departmental work control processes, and the management of the change process for changes in hazards is not defined. (See Finding #C-1.)

Engineering controls within the Microsystems Science, Technology & Components Center are generally robust and state-of-the art. The mechanisms that define hazard controls have improved since the 2005 Independent Oversight inspection. However, at the activity level, hazard controls are sometimes not specifically identified, and the linkage of a control to the hazard it was intended to mitigate is not always well defined. Most light lab departments have not documented an adequate work control process that meets SNL requirements for identifying controls. In some cases, controls have not been prescribed for identified hazards. (See Finding #C-1.)

Most observed work in both the light and heavy labs was performed within specified controls, and work authorization processes have been developed at the departmental level. However, as noted above, hazard controls are not always adequately specified, as demonstrated be a recent incident involving hydrogen chloride fumes in one of the heavy labs. (See Finding #C-1.)

Overall, SNL has made improvements in some aspects of work planning and control processes at the Microsystems Science, Technology & Components Center. In addition, some hazards analysis process elements, such as occupational exposure assessments, and many hazard controls (e.g., engineering controls) are effective. When controls are adequately defined and communicated, most observed work was performed within specified controls, and work authorization processes have been developed at the departmental level. However, the light labs have not documented a detailed work control process that implements all aspects of the SNL institutional work control requirements. As a result, the expectations for work definition, hazard identification, and documentation of hazard controls are not clear at the task level. At the task or activity level within the light labs, hazards are sometimes not sufficiently identified or analyzed, hazard controls are sometimes not adequately specified, and the linkage between controls and the associated hazard is often not well defined.

Responsive Neutron Generator Product Deployment Center

Independent Oversight observed the work activities of several different manufacturing teams within the Responsive Neutron Generator Product Deployment Center (Center 2700) in several different work areas and buildings and during nearly all facets of fabrication, assembly, inspection, and testing of neutron generator subassemblies and complete neutron generators. The review included assessment of the associated hazard analysis documents and technical work documents (operating procedures and work instructions) in controlling the hazards and hazardous materials associated with neutron generator production (e.g., high voltage, radiation, toxic materials, carcinogens, flammable liquids and gases, lasers, x-rays, explosive hazards, and other physical hazards such as sharps and extreme thermal hazards).

Center 2700 has adequately defined the scope of work of production processes in sufficient detail to permit adequate identification and analysis of the hazards to workers, the public, and the environment.

Neutron generator production hazards are adequately identified and analyzed. Comprehensive baseline occupational exposure assessments have been performed as required. Management has demonstrated a notable commitment to worker involvement in the hazard analysis process.

Center 2700 has identified the appropriate hazard controls for production work activities. The primary controlling work documents – operating procedures and work instructions – are comprehensive and effectively include the appropriate administrative hazard controls and specific personal protective equipment. In several cases, Center 2700 has identified unique or notable practices to ensure that ES&H risks are minimized (e.g., substitution for hazardous materials, techniques to promote good housekeeping).

Center 2700 work is authorized and performed in strict accordance with established controls by highly competent and knowledgeable workers. Workers were aware of their stop-work authority and indicated that they would not hesitate to use that authority if there was any question of the safety of an activity.

Overall, Center 2700 has effectively implemented the ISM process at the task level. Work is adequately defined and scheduled. Neutron generator production hazards are adequately identified, analyzed, and controlled. Production work is authorized and performed in strict accordance with established controls. In addition, management has demonstrated a notable commitment to worker involvement in the hazard analysis process and, in several cases, has identified unique or notable practices to ensure that ES&H risks are minimized.

Waste Management Operations at Regulated Waste/Nuclear Material Disposition Department

The RWNMDD provides waste management services to SNL including management and disposal of radioactive, mixed, hazardous and solid waste streams. Independent Oversight reviewed work activities at two of the Department's waste management facilities operating as Resource Conservation and Recovery Act-permitted or interim-permitted facilities (RMWMF and HWMF). Operations reviewed in these facilities included routine material handling and movement, radioactive and mixed waste treatment and sorting, hazardous waste collection and transport, and hazardous waste laboratory packing.

The scope of waste management activities is well defined through programs plans. The scopes are further subdivided into clear and manageable activities and tasks through a combination of subordinate mechanisms including operating procedures and supporting technical work documents specific to individual activities and tasks.

Most significant hazards associated with facility- and process-level work within RWNMDD are adequately identified through the use of the primary hazard screens and subordinate hazard analyses. For instance, for

RMWMF work that involves opening, inspecting, handling, and treating waste materials, comprehensive analysis of both radiological and non-radiological hazards is accomplished through a systematic process that includes development of campaign-specific work plans addressing hazards associated with each individual waste container to be handled. Although higher-risk activities (e.g., hands-on work with radioactive material) are effectively managed, RWNMDD has not implemented sufficient department-specific hazard analysis processes for some routine and lower-risk operations to ensure that hazards are adequately identified and analyzed. (See Finding #C-1.)

RMWMF has developed a rigorous and noteworthy protocol for developing campaign-specific waste sorting and treatment plans that clearly convey to the worker the hazards, controls, and tasks associated with all waste processing activities. Radiological, environmental, and industrial controls were well integrated into these work plans. For routine work at RWNMDD covered only by facility operating procedures, specific controls were not always clearly defined or implemented. In addition, some Occupational Safety and Health Administration (OSHA) respiratory protection requirements have not been effectively implemented. Radiological controls are generally effective, and well qualified health physics personnel oversee and support day-to-day operations. However, a systematic concern was identified in the area of air sampling and monitoring, which are not supported by an adequate technical basis either at the facility or institutional level. A related concern was captured through recent self-assessments. SNL convened a team to review these concerns.

Readiness to perform work is accomplished through various means including routine meetings such as plan of the day, plan of the week, scheduled safety meetings, and pre-job briefings. Work was performed safely, and housekeeping and environmental compliance requirements were effectively implemented.

Overall, RWNMDD has made improvements in work planning and control since it was last reviewed by Independent Oversight in 2003. Many aspects of work scopes, hazard analysis and control, and work performance were effective and some were noteworthy, such as the additional rigor placed on the development of specific waste sorting and treatment plans. There are a few exceptions in such areas as routine work and certain elements of respiratory protection and radiological air monitoring and sampling. In addition, while RMWMF has developed and documented a mature work control process that is consistent with SNL institutional requirements, other departmental facilities within the scope of the Department 4110/4130 work control management plan do not have work control processes that meet SNL and ISM requirements.

Maintenance

Maintenance at SNL is managed and conducted primarily by FMOC. Independent Oversight evaluated work performed by FMOC in facilities located throughout several Technical Areas, maintenance shops, and several other buildings, including preventive and corrective maintenance and modification activities.

Many work definitions for SNL FMOC maintenance are adequate for SNL crafts to determine the potential hazards. Written work definitions in work orders provide limited detail in some cases, placing reliance on the worker to identify hazards during walkdowns. However, most work scopes are adequately defined for the limited set of activities performed by crafts personnel.

Hazard analysis processes have been strengthened since the 2005 Independent Oversight inspection. SNL has conducted many baseline occupational exposure assessments of maintenance-related activities and several comprehensive FMOC assessments of maintenance work planning. FMOC assessments have observed similar deficiencies, and some process improvements have been implemented; however, some of these corrective actions have been insufficient. The existing process continues to have gaps where hazards can be missed. Additionally, the work planning process is over-reliant on the worker's walkdown and assessment, sometimes

without benefit of line supervision or ES&H subject matter expert input, resulting in some hazards that were not identified or analyzed. (See Finding #C-1.)

The use of operating procedures that address broad categories of work for the performance of many types of maintenance work has resulted in a system where workers are expected to choose the controls they believe are applicable, instead of being provided with a set of controls that must be implemented. Although SNL has taken important steps since 2005 to improve workers' understanding of applicable controls, through implementation of the Pre-Task ES&H Checklists process, the process is not always effective because it relies too much on the workers to know when to seek assistance from ES&H subject matter experts in establishing controls and what questions to ask, and the workers do not necessarily have the necessary training and expertise to implement their assigned responsibilities. In some cases, workers were either unaware of or uncertain about the proper hazard controls because of the weaknesses in hazard identification and control processes. (See Finding #C-2.)

With a few exceptions, workers demonstrated a good understanding of ES&H requirements and followed controls, when controls were clearly established. Most observed work was safely performed in accordance with established controls.

Overall, SNL has made a number of improvements in work planning and control processes since 2005. For the most part, work scopes are adequately defined, and workers follow the controls that are clearly established and communicated. However, the processes for hazard identification, analysis, and controls have gaps and rely too much on the workers to identify hazards and select controls; in many cases, workers identify hazards and select controls after the work has been authorized.

Construction

Independent Oversight reviewed programs and procedures and observed construction work to assess the safety of construction managed by the SNL FMOC. The Independent Oversight team reviewed documents and observed subcontractor work (including prime and subtier) associated with facility upgrades, construction of a new modular building, decontamination and decommissioning activities, installation of boilers, and asphalt repairs.

The scope of construction work is adequately defined through contracts, drawings, and specifications. Work scopes are adequately broken down into tasks in documented task hazard analyses to support identification of associated hazards and controls.

Processes for identification and analysis of hazards have improved since the 2005 Independent Oversight inspection and were effectively implemented for most of the work observed during this inspection. Processes have been effective in identifying physical hazards, and workers demonstrated a good understanding of the physical hazards. However, activity-level hazard analyses are not consistently prepared as required by construction contracts and 10 CFR 851. Also, implementation of the hazard analysis processes has been less effective for electrical and health hazards, contributing to situations where a few workplace hazards were not adequately identified, analyzed, and understood by workers. (See Findings #C-3 and C-4.)

SNL has taken important steps to improve workers' understanding of applicable controls since 2005. Most subcontractors use documented task hazard analyses to remind workers of applicable controls before they begin work each day. SNL has established appropriate ES&H requirements in construction contracts, and SNL safety professionals and construction observers closely monitor implementation of these requirements.

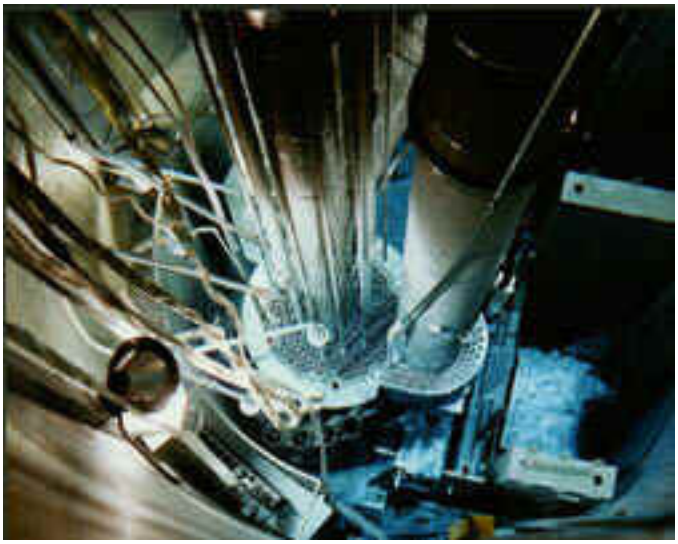
Although contract-specific safety plans do not fully address some contract requirements, safety expectations are conveyed through other means and implementation of ES&H controls has been generally effective.

Workers demonstrated a good understanding of ES&H requirements and a willingness to follow them. Most observed work was performed safely in accordance with established controls.

Overall, improvements in construction safety programs and practices since the 2005 Independent Oversight inspection indicate a strong commitment to improve the safety of construction work. Flowdown of requirements has improved, and a more systematic work control process is in place. However, additional improvements are needed in a few areas, including review of contract-specific safety plans, development of activity hazard analyses, improvement of task hazard analyses, and implementation of National Fire Protection Association (NFPA) 70E electrical safety requirements. Analysis of health hazards has improved, but continued focus on improving SNL's monitoring of potential exposures to hazardous materials is needed.

4.2 Essential System Functionality

The review of essential system functionality focused on three areas: (1) functionality of selected essential systems at the ACRRF, which is a hazard category 2 nuclear facility; (2) effectiveness of SNL corrective actions in addressing the findings from the 2005 Independent Oversight inspection; and (3) the SNL cognizant system engineer program and the SSOE program.



Annular Core Research Reactor

Functionality of Selected Essential Systems at the ACRRF

Engineering Design and Safety Basis. Through its safety basis improvement project, SNL has made significant progress in improving safety basis development and maintenance processes and implementing a revised DSA for the ACRRF. All engineering and safety basis staff contacted during this inspection demonstrated a high degree of technical competence, personal dedication, and ownership of their responsibilities. Although the safety bases were generally well written and complete, two major concerns were identified with the FREC II (which is one of the two reactor cores in the ACRR) fuel bounding case cladding thermal-hydraulic/ structural analyses described in the DSA. First, the DSA incorrectly identified the cladding ultimate tensile strength as the bounding parameter whereas it was actually the minimum critical heat flux ratio. Second, the DSA did not adequately address the loads and resultant stresses imposed on the cladding due to differential thermal expansion of the fuel and the cladding. These additional stresses, when properly considered, have the potential to reduce design margins and lower the FREC II fuel bounding case power value if analyses indicate that ultimate tensile strength is reached at a power less than the current minimum critical heat flux ratio related bounding power limit. In addition, Independent Oversight identified one instance where appropriate controls were not instituted to ensure that a critical accident analysis assumption was valid. Specifically, for the "Heavy Load Dropped On Core" accident, safe operation is

predicated on an assumption that the reactor is not operating at the time a heavy load is dropped, but there is no control in place (e.g., a facility procedural requirement) to preclude loads from being lifted over the reactor while it is in operation. SNL has addressed this concern with an interim restriction. (See Findings #E-1 and #E-5.)

Configuration Management. The USQ program at SNL has shown significant improvement since the 2005 Independent Oversight assessment. The quality of the new procedure, conformance to 10 CFR 830 and the DOE USQ Guide, and execution of the process have all improved. Although the procedure contains some wording ambiguities and inconsistencies, which are being corrected, the process and its implementation are now generally adequately defined and well executed.

The processes for engineering and configuration management are also improving. However, a number of implementation weaknesses were identified in relation to the change control aspect of the configuration management process. There are no compensatory measures for the areas where compliance has not been achieved. Further, the development and implementation of the configuration management plan have been inadequate. (See Finding #E-2.)

The ACRR safety instrumentation and control software is controlled by knowledgeable and experienced technical staff, and the recent software upgrades and changes were made according to existing procedures. However, the safety software quality assurance requirements of DOE Order 414.1C, which provide for a high level of rigor and safety assurance through the application of specific standards at the life-cycle activity level, have not yet been implemented at Technical Area V nuclear facilities. Further, there is no formal schedule for such implementation. SNL has not adequately defined full implementation of the DOE order. While SSO recognized the shortcomings of SNL's initial implementation plan, it has not ensured comprehensive and full implementation of the DOE order requirements, including approval of the standards to be applied. (See Finding #E-3.)

Operations and Surveillance Testing. The ACRRF operations staff is very well qualified and knowledgeable. Operating procedures generally are well written, controlled, and carefully performed. Surveillance tracking processes are adequate, and surveillance procedures are adequate to implement the technical safety requirements (TSRs). Several aspects of operations, however, do not ensure sufficient formality of operations (e.g., clarity of roles, valve lineup aids, use of current directives, preventive maintenance and surveillance logs, deficiency reporting, and performing operability determinations). For example, deficiency reports were not entered in several cases (e.g., water leak, a stuck transient rod, and battery failures). In addition, ACRRF troubleshooting procedures do not always provide sufficient detail. (See Finding #E-4.)

Maintenance. The Technical Area V ACRRF maintenance program and activities meet most aspects of the requirements of DOE's maintenance order. The SNL condition assessment survey program description document and implementation meet the requirements of DOE's real property asset management order. An Internal Lease Agreement between Technical Area V and FMOC clarifies and assigns respective maintenance and configuration management implementation responsibilities at Technical Area V. Plans and actions to improve Maintenance Implementation Plan implementation are ongoing; however, improvements in electronic databases for equipment configuration, maintenance history, and other key information, as well as in cognizant system engineer program activities, have not been completed. Observed ACRRF safety systems, structures, and components evidenced good condition. The programmatic corrective maintenance backlog was minimal, and all programmatic preventive maintenance was current. The ACRRF programmatic and real property maintenance activities have generally been effective in maintaining safety-significant, defense-in-depth, and mission-critical systems, structures, and components in a fit-for-use condition. Implementation of the Quality-Significant Procurement Handbook assures that procurements of Quality Level 1 and 2 safety systems,

structures, and components meet the procurement requirements of 10 CFR 830.122 and DOE Order 414.1C. The SNL program for suspect/counterfeit items is comprehensive and implemented with sufficient rigor.

However, several deficiencies in implementation of Technical Area V's Maintenance Implementation Plan and quality assurance requirements were identified. There were a number of failures to appropriately document identified quality problems, evaluate cause, develop and implement corrective actions to prevent recurrence, and track the status to closure. There were also examples that reflect a lack of rigor and formality in the conduct of operations, surveillance, and maintenance, and in performing work using inadequate or unapproved procedures or without adequate controls. (Also see discussion under Operations and Surveillance Testing.) (See Findings #E-4 and E-5.)

SNL Cognizant System Engineer and SSO SSOE Programs

The Technical Area V cognizant system engineer program description generally meets the requirements of DOE Order 420.1B. Further, significant progress has been made in developing the program and its implementing procedures, and the improvements in program implementation since the 2005 Independent Oversight inspection despite staffing limitations are noteworthy. However, program implementation is not mature, and significant additional effort is required for full implementation. (See Finding #E-6.)

SSO has made significant progress in establishing and implementing an effective SSOE program since the 2005 Independent Oversight Inspection. In particular, the SSOE program has been monitoring the contractor's progress in establishing the cognizant system engineering and configuration management programs, implementing safety software quality assurance requirements, and providing feedback to the contractor for improvement. However, it has not yet been fully effective in driving timely improvements in contractor performance in these areas.

Effectiveness of Corrective Actions for Essential System Functionality Findings

SNL has taken generally appropriate steps toward addressing all of the findings from the 2005 Independent Oversight inspection. With one important exception, the corrective actions have been adequate to address the finding. For many of the other 2005 inspection findings, the newly approved DSAs and TSRs, which constitute a major change to the safety basis documentation, serve as the primary deliverable for correcting the identified issues. Many of GIF's and ACRRF's corrective actions are sound and generally acceptable, although Independent Oversight has identified some opportunities for improvement. However, one exception is the finding related to deficiencies in configuration management at GIF, for which some of the corrective actions were not fully effective. The development and implementation of the configuration management plan has been inadequate, and the corrective actions for this finding were not fully effective. Programmatically, however, SNL has failed to adequately consider the extent of condition of deficiencies at other SNL nuclear and non-nuclear facilities, as appropriate. (See Findings #E-2 and D-4.)

Overall Perspectives on Essetial System Functionality

Since the previous Independent Oversight inspection in 2005, SNL has made some notable improvements in improving safety basis processes, developing significantly improved safety basis documents, developing and implementing a fully revised USQ procedure and program, and making progress towards establishing the configuration management and cognizant system engineer programs.

Notwithstanding the significant improvements and efforts, increased management attention is needed in several areas. Although the safety bases have been generally well-developed, deficiencies in the safety analysis for ACRRF fuel cladding warrant further analysis and corrective actions. In addition, the cognizant system

engineer, configuration management, and software quality assurance programs and their implementation have several important gaps and deficiencies, and their implementation has been significantly delayed beyond the committed completion date. The schedules for full implementation of these programs are not defined and warrant timely management attention to establish interim compensatory measures and plans and milestones for full implementation. Further, a concerted effort is needed to achieve the necessary level of rigor, discipline, and formality in conduct of operations, surveillance testing, and maintenance. Also, the identification and tracking of deficiencies and problems are insufficient, and significant management attention is needed to successfully complete the Technical Area V initiatives to integrate its databases and improve condition reporting, action tracking, and performance monitoring. SNL conducted a self-assessment just prior to Independent Oversight's inspection, but it was not effective in identifying a number of gaps and deficiencies. Finally, although SNL took generally adequate corrective actions for addressing the essential system functionality findings from Independent Oversight's previous inspection in 2005, it did not adequately evaluate and document the extent of condition of important deficiencies.

4.3 Focus Areas

Chemical Management

SNL has an effective system for controlling most chemicals that are brought on site; maintaining a chemical information system for inventory management, and meeting most requirements of OSHA's hazard communication and laboratory standards. The implementation of a just-in-time program, using approved vendors to supply most of the chemicals procured by SNL, minimizes the introduction of chemicals that have not been reviewed and approved and reduces on-hand inventory. The approved vendors supplying laboratory chemicals and compressed gases also directly enter delivered materials into the site's chemical information system. SNL has implemented hazard communication and chemical hygiene programs for in-house operations and uses the chemical information system in support of those programs. However, a few aspects of the implementation of SNL chemical management warrant further improvement, including processes for ensuring that chemicals are not removed from the chemical management system before those materials are consumed or disposed of as waste and that material safety data sheets for older product formulations still in use at SNL are maintained and provide correct information about hazards. In addition, potential hazards from chemicals introduced by construction subcontractors are not adequately addressed in SNL practices and procedures to ensure that carcinogens are controlled and that personnel in the areas near construction worksites are aware of and protected from any chemical hazards used in construction sites. (See Finding #F-1.)

Radioactive Waste Activities

Hazardous Waste Management

SNL has effectively implemented a waste management program that provides assurance that regulatory requirements are met. This program includes adequate institutional waste management requirements in the

ES&H Manual, training for personnel generating and managing hazardous waste, requirements to incorporate hazardous waste management into work documents, a hazardous waste tracking system, and deployment of hazardous waste expertise to support line organizations. Line organizations are performing most aspects of hazardous waste management effectively and in accordance with site and regulatory requirements, including performance at the point of generation and in less-than-90-day storage/accumulation areas. However, several satellite accumulation points are operated in a manner that could contribute to incorrect categorizations or missed opportunities to minimize waste for certain situations, and controls for painting operations in the maintenance shop areas need to be strengthened to ensure full compliance with applicable requirements.

Specific Administrative Controls

SNL has formulated and implemented a systematic process for the development of safety bases that addresses the guidance and requirements associated with SACs as defined in DOE Standard 3009, Change Notice 3, and DOE Standard 1186-2004. As part of the corrective actions to address the 2005 Independent Oversight inspection, SNL has taken positive steps to correct and improve weaknesses in safety bases at its nuclear facilities, including upgrading existing DSAs to address SACs and bring SNL nuclear facilities into compliance with 10 CFR 830 requirements. With one exception, SNL nuclear facilities have approved and fully implemented upgraded DSAs that address SACs; an upgraded DSA is in the implementation process for the one exception. In addition, SSO provides adequate oversight of SAC implementation. SACs established for GIF effectively address 2005 Independent Oversight worker safety concerns. SNL has conducted several rigorous assessments that are contributing to the identification of improvements needed in SAC development and implementation for nuclear facilities. SNL and SSO are taking positive steps to further strengthen SAC development and implementation processes. However, SNL needs to ensure that all potential inconsistencies in GIF and ACRR SACs are fully identified and evaluated as part of the ongoing process improvement efforts.

Injury and Illness Reporting

Overall injury and illness rates have continued to improve, and improvements have been made in the injury investigation reporting processes. However, weaknesses in investigation, analysis, and recurrence controls for occupational injuries and illnesses persist. There are deficiencies in the communication of requirements and investigations, and the resulting corrective and preventive actions are still not sufficiently rigorous. There are insufficient monitoring and controls on the quality of program outputs (i.e., investigation reports and corrective/preventive actions). (See Findings #D-3 and D-4.)

4.4 Feedback and Improvement Systems

SSO

SSO has made progress in strengthening their oversight processes and management systems in a number of areas. For example, staff capabilities have been strengthened by increased senior SSO manager coaching and development of staff. Also, the SSO Facility Representative program has been strengthened by standardization efforts and the recent emphasis on training of Facility Representatives. Further, the SSOE program has been significantly improved. SSO has also established the Pegasus tool for managing information including tracking of corrective actions. SSO established a Joint Performance Council supported by Joint Performance Review Teams that are communicate the status of performance. SSO has established an effective working relationship with SNL, resulting in many collaborative efforts. As a result of these efforts, many aspects of the SSO oversight program and ES&H responsibilities are effectively implemented such as the Facility

Representative program, the technical qualification program, operating experience/lessons learned program, and the FEOSH program.

SSO's concepts for the model contract are appropriate, and progress is being made towards model contract implementation and transition from transactional-level oversight to a systems-level oversight approach for certain activities (e.g., non-nuclear facilities that are not considered high hazard). Mechanisms including the Risk Based Oversight Board have been established to manage this transition. However, SSO's transition to systems-based oversight places reliance on the SNL contractor assurance system, which is not sufficiently mature and has not been effectively implemented. The decision to transition some oversight to a systems level was based on an analysis of program health for functional areas; if the health was determined to be adequate and there was confidence in the contractor assurance system, then SSO decided to shift to systems-level oversight. Based on these analyses, decisions were made to shift seven of eight ES&H functional areas. However, Independent Oversight found that the data supporting these decisions did not provide adequate characterization of contractor assurance system implementation.

A number of weaknesses were identified in implementation of SSO ES&H oversight resulted, in part, from the ongoing transition and/or the learning curve associates with new tools, such as Pegasus. Continued management attention and effort are needed to improve the quality of products, including development of adequate baseline oversight program. In addition, while SSO's management of contract mechanisms has driven improvements, there are some important ES&H areas where actions have not been effective or timely. Although configuration management for nuclear facilities was identified as an issue during the 2005 Independent Oversight inspection, SNL and SSO closed the finding without establishing a fully effective configuration management program. In addition, although progress has been made, contract management tools have not been used effectively to drive timely improvements in several important elements of a nuclear safety program (i.e., configuration management, software quality assurance, and the cognizant system engineer program). Improvements have been noted in work planning and control and the SNL contractor assurance system, but comprehensive actions to improve the quality of contractor assurance system products and ensure that institutional work planning and control requirements are understood and effectively implemented within organizations are not in place, and contract mechanisms to drive these important and necessary improvements are not being used effectively.

SNL

SNL has made progress in strengthening feedback and improvement processes and management tools since 2005. SNL has established and implemented the safety assurance elements defined in DOE Order 226.1A, and these elements are contributing to safer conditions and work performance and environmental protection at SNL. The ILMS describes the SNL contractor assurance system: an integrated set of requirements and practices for corporate assurance that includes risk management, self-assessment, issues management, corrective action, and management assurance. The ES&H assurance system is further described in the SNL ISM program description and the ES&H assurance system description. SNL, in coordination with SSO, has also devoted significant effort to self-assessments of SNL activities using the Independent Oversight criteria review and approach documents in preparation for this Independent Oversight inspection.

SNL conducts a variety of assessment activities that identify deficiencies in safety processes, conditions, and performance, but the program still lacks the consistency and rigor of a mature and effective performance assurance system in evaluating ISM processes and performance. Process improvements have been made and improvement initiatives are ongoing, but the corrective actions for prior Independent Oversight findings in this area have not been fully effective. Weaknesses remain in the associated processes and procedures,

and implementation by line and support organizations has been inconsistent and lacked sufficient rigor to effectively evaluate the adequacy of processes, programs, and performance. Requirements documents lacked sufficient comprehensiveness and integration. At the division level and in most line organizations, self-assessment planning and scheduling are not sufficiently rigorous or based on a documented risk assessment of all activities, facilities, management systems, and vulnerabilities. Assessments have insufficient focus on management systems and work performance, and implementation and assessment reporting documentation does not include key elements, such as criteria, scope, and analysis and conclusions. Self-assessments of each of the above assurance system elements have primarily focused on process adequacy, with little direct evaluation of implementation, specifically the quality of the outputs of these processes (e.g., reports, causal analysis, corrective action plans). (See Findings #D-2 and D-3.)

SNL has made progress in establishing an institutional approach to ES&H issues management. Line organizations have accepted more responsibility for documenting problems and managing them to completion. However, existing corrective action requirements in other documents have not been integrated into the revised corporate corrective action process, the processes and requirement for management of some types of safety problems have not been not adequately defined, and some identified safety problems are not being adequately managed or analyzed to identify appropriate recurrence controls. Deficiencies remain in the communication of requirements for corrective action and issues management in SNL documents and in program implementation. The new corporate corrective action process requirements document was not properly integrated with pre-existing and continuing requirement and guidance documents, resulting in conflicts and redundancies, and its implementation has not been effectively managed and monitored. The requirements for managing some deficiencies are not sufficiently defined, and issues management for these processes has been deficient in many instances. Assessment results of the same significance level are managed differently depending on the source of the issue. Implementation deficiencies included incorrect categorization of assessment results and insufficient causal analysis and identification of recurrence controls. Undocumented or inadequate causal analysis was identified in numerous cases in all types of problem reporting and resolution documents. (See Findings #D-3 and D-4.)

Events are being identified at an appropriate threshold, reported, investigated and managed at SNL. Although there is a well-established program for managing and reporting events, communication of procedures and requirements is insufficient, and investigations and corrective/preventive actions are sometimes not sufficiently rigorous. Requirements and guidance for event reporting are contained in numerous places, including intranet sites and guidance documents, many of which are not subject to formal document control or institutional authority. In many cases, event investigation activities are not performed with sufficient rigor to consistently and effectively identify causes and appropriate recurrence controls. Externally generated lessons learned are screened, evaluated, disseminated, and shared with workers, and internal lessons learned are generated and disseminated. However, lessons-learned procedures and requirements are insufficiently defined and documented (e.g., applicability reviews for externally generated DOE lessons learned). (See Findings #D-3 and D-4.)

SNL employees and contractors have various informal and formal means to raise and obtain resolution of ES&H concerns. The various organizations that were reviewed during this Independent Oversight inspection have established and implemented a number of mechanisms for collecting activity level feedback and using that input to make ES&H improvements. Some elements of activity level feedback in some organizations were effective and were contributing to a safer workplace. However, there are some weaknesses in processes (e.g., inadequate direction to SNL organizations for performing activity-level feedback) and performance (e.g., deficiencies in use of personal protective equipment not identified by supervisors, longstanding use of inadequate work control processes). (See Finding #D-2.)

Although SNL has taken actions to improve corrective action management at SNL, the fundamental deficiencies in assessments, corrective action management, injury and illness reporting, and lessons learned identified during previous Independent Oversight inspections have not yet been fully addressed. All corrective actions for the three feedback and improvement findings from the 2005 Independent Oversight inspections (i.e., findings related to assessments, issues management, and injury and illness investigations) have been closed in the DOE Corrective Action Tracking System database by SNL and verified as effective by SSO. However, Independent Oversight has determined that many of the weaknesses and deficiencies cited in the 2005 report remain problematic at SNL. Continuing deficiencies were also identified during this inspection in SNL fully resolving previous Independent Oversight findings for configuration management and work planning and control. The causal analysis for these findings did not adequately identify root and contributing causes, the specified corrective actions were not fully effective in addressing these findings, and the validation reviews conducted by SNL and the DOE effectiveness assessments were insufficiently rigorous to identify the continuing process and performance deficiencies. Specifically, the corrective action plans and verification and validation activities addressed the processes involved, but did not adequately address the quality of output products from these processes. (See Finding #D-4.)

Overall, SNL has made progress in strengthening feedback and improvement processes and management tools since 2005, and overall injury and illness rates have continued to improve. However, most of these new and revised processes are still immature, and overall progress has been slow. In general, these process improvements have not been sufficiently comprehensive, and communication of requirements has been deficient. Implementation of assurance system elements is often not sufficiently rigorous. Many of the feedback and improvement deficiencies identified during prior Independent Oversight inspections continue to exist because the root causes of feedback and improvement program weaknesses have not been sufficiently identified and addressed and corrective actions have focused on process changes without sufficient review and assurance of adequate implementation.

5 Conclusions

SSO and SNL senior management commitment to ES&H improvements is evident and has contributed to improvements in all areas since the previous independent oversight inspection in 2005. Collaborative mechanisms have been established to manage performance evaluation plans and reports. SSO has established new processes and tools to improve and support implementation of the model contract. SSO has also made improvements in important areas, such as nuclear facility safety system oversight, and has used contract mechanisms to drive improvements SNL has made improvements in work planning and control and the contractor assurance system. Nuclear facility safety basis documents have been significantly improved. Improvements are also evident in safety management of subcontractors and workplace monitoring programs. SNL has a number of notably effective aspects of safety management in one or more facilities, such as engineering controls at certain Microsystems Science, Technology & Components Center operations and work planning and control processes for neutron generator production activities.

However, SSO and SNL have not been effective in ensuring timely and effective resolution for some deficiencies. In the area of essential system functionality, there are gaps in important programs, such as configuration management, software quality assurance, and the cognizant system engineer program, and the levels of rigor and formality expected of a nuclear facility have not been fully achieved. While SSO and SNL management recognize that work planning and control continues to need improvement, SNL improvement efforts, direction, and evaluations have not been sufficient to ensure that all SNL organizations understand and effectively implement DOE requirements for an effective work control process. Continued weaknesses in important aspects of the contractor assurance system are also evident, and actions to integrate processes and improve the quality of products are lacking and/or have not been sufficiently effective. Although improvement is evident, SSO has deficiencies in its oversight program (e.g., assessments), and SSO's oversight of SNL and use of contract management tools has not been sufficiently effective in ensuring timely resolution of previously identified deficiencies in SNL's programs in important areas, such as work planning and control, the contractor assurance system, and configuration management, software quality assurance, and systems engineering for nuclear facilities.

Increased SSO and SNL management attention is needed to ensure timely and effective correction of these longstanding weaknesses. Particular emphasis needs to be applied to:

- Developing and implementing a comprehensive institutional approach to correct longstanding work planning and control deficiencies across all SNL organizations and facilities in a timely manner that provides adequate direction (e.g., improved SNL requirements), ensures that requirements are understood and effectively implemented by line organizations, and provides for rigorous and timely evaluation of the effectiveness of implementation.

- Enhancing the SNL contractor assurance system by establishing clear requirements, developing and/or completing key program elements (e.g., causal analysis), and rigorously evaluating the effectiveness of process changes

- Ensuring full and effective implementation of nuclear safety requirements (e.g., configuration management, software quality assurance, cognizant systems engineer, and formal and rigorous operations) for nuclear facilities in a timely manner

- Evaluating the benefits of using formal project management techniques, including senior management monitoring and controls, to manage the development and implementation of the needed improvements.

In addition, SSO needs to continue ongoing improvement initiatives, ensure that the SSO program continues to develop and mature, and address the current SSO program deficiencies, with particular attention to establishing an adequate baseline SSO Office of Environment, Safety, Health and Quality Assurance (ESH&QA) oversight program and establishing expectations for an effective systems-level oversight program. SSO also needs to continue improving implementation of contract management tools (e.g., utilizing performance objectives targeted at the identified deficiencies and/or better aligned to performance) to drive improvements and ensure contractor accountability for performance.

6 Ratings

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

Work Planning and Control				
ACTIVITY	**CORE FUNCTION RATINGS**			
	Core Function #1 – Define the Scope of Work	**Core Function #2 – Analyze the Hazards**	**Core Function #3 – Develop and Implement Controls**	**Core Function #4 – Perform Work Within Controls**
Microsystems Science, Technology & Components Center	Effective Performance	Needs Improvement	Needs Improvement	Effective Performance
Responsive Neutron Generator Product Deployment Center (Center 2700)	Effective Performance	Effective Performance	Effective Performance	Effective Performance
Waste Management Operations at RWNMDD	Effective Performance	Effective Performance	Needs Improvement	Effective Performance
Maintenance	Effective Performance	Needs Improvement	Needs Improvement	Effective Performance
Construction	Effective Performance	Needs Improvement	Effective Performance	Effective Performance

Essential System Functionality	
Engineering Design and Authorization Basis	Needs Improvement
Configuration Management	Needs Improvement
Operations and Surveillance Testing	Needs Improvement
Maintenance	Needs Improvement
System Engineering and Oversight	Needs Improvement

Feedback and Continuous Improvement - Core Function #5	
SSO Feedback and Continuous Improvement Processes	Needs Improvement
SNL Feedback and Continuous Improvement Processes	Needs Improvement

APPENDIX A
Supplemental Information

A.1 Dates of Review

Planning Visit	January 14 –17, 2008
Onsite Inspection Visit	January 28 – February 7, 2008
Report Validation and Closeout	February 26 – 28, 2008

A.2 Review Team Composition

A.2.1 Management

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

A.2.2 Quality Review Board

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

A.2.3 Review Team

Thomas Staker, Team Leader
Shiv Seth, Essential System Functionality Lead

Phil Aiken	Vic Crawford	Larry Denicola	Bob Freeman
Bob Guy	Janet Macon	Marvin Mielke	Bob Compton
Al Gibson	Ed Greenman	Jon Johnson	Joe Lischinsky
Jim Lockridge	Tim Martin	Joe Panchison	Don Prevatte
Michael Shlyamberg	Ed Stafford	Mario Vigliani	

A.2.4 Administrative Support

Mary Anne Sirk	Tom Davis

A.3 Ratings

The Office of Independent Oversight uses a three-tier rating system that is intended to provide line management with a tool for determining where resources might be applied toward improving environment, safety, and health. It is not intended to provide a relative rating between specific facilities or programs at different sites because of the many differences in missions, hazards,

and facility life cycles, and the fact that these reviews use a sampling technique to evaluate management systems and programs. The rating system helps to communicate performance information quickly and simply. The three ratings and the associated management responses are:

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

- **Needs Improvement (Yellow):** Indicates a need for improvement and a significant increase in attention to a management system or program. This rating is anticipatory and provides an opportunity for line management to correct and improve performance before it results in a significant weakness.

- **Effective Performance (Green):** Indicates effective overall performance in a management system or program. There may be specific findings or deficiencies that require attention and resolution, but that do not degrade the overall effectiveness of the system or program.

APPENDIX B
Site-Specific Findings

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

	FINDING STATEMENTS
C-1	SNL has not provided sufficient direction and has not performed sufficient evaluations to ensure that work planning and control processes meet SNL requirements and are effective in identifying, analyzing, and controlling workplace hazards across SNL organizations, and that implementation deficiencies are identified and corrected in a timely manner, as required by DOE Manual 450.4-1, *Integrated Safety Management Manual*; 10 CFR 851; and SNL CPR001.3.14, *Work Planning and Control*.
C-2	For some SNL FMOC maintenance work activities and/or facilities, SNL has not adequately identified or effectively implemented appropriate hazard controls in accordance with DOE Manual 450.4-1, *Integrated Safety Management Manual*.
C-3	SNL has not ensured that construction subcontractors prepare activity hazard analyses as required by 10 CFR 851; has not ensured that construction subcontractors perform task hazard analyses that adequately identify, analyze, and link health hazards to assigned tasks and controls, consistent with DOE Manual 450.4-1, *Integrated Safety Management Manual*; and has not established an effective process for ensuring that workers acknowledge being informed of hazards as required by 10 CFR 851.
C-4	SNL has not ensured that construction subcontractors prepare lockout/tagout programs that fully implement the NFPA 70E lockout/tagout requirements and has not ensured that construction subcontractors perform flash hazard analyses to establish arc flash boundaries and personal protective equipment requirements, as required by NFPA 70E.
D-1	SSO has not established an adequate ESH&QA baseline assessment program in accordance with DOE Order 226.1A, *Implementation of DOE Oversight Policy*, in that expectations relative to the systems-based oversight assessment methodology have not been communicated to SSO staff, and the master assessment schedule does not support an adequate demonstration of functional area coverage for either transactional or systems-based oversight.
D-2	Contrary to the requirements of DOE Order 226.1A, *Implementation of Department of Energy Oversight Policy*, SNL's ES&H assessment program is not sufficiently comprehensive or fully effective in ensuring that ES&H management systems, programs, and performance at all levels and in all organizations are consistently and accurately evaluated.
D-3	SNL has not effectively communicated requirements and procedures for implementing assurance system programs as required by SNL CPR001.1, *Corporate Business Rules System Standard*, and DOE Order 414.1C, *Quality Assurance*.

FINDING STATEMENTS	
D-4	Contrary to the requirements of DOE Order 226.1A, *Implementation of Department of Energy Oversight Policy*, the SNL corrective action program is not sufficiently comprehensive or fully effective in ensuring that safety deficiencies are appropriately documented, rigorously categorized, and evaluated, with root causes and extent of condition accurately identified, and that appropriate and effective recurrence controls are identified and implemented.
E-1	Contrary to the requirements of DOE Order 5480.30, *Nuclear Reactor Safety Design Criteria,* for establishing appropriate design margin, the ACRRF DSA bounding case thermal-hydraulic/structural analysis for the FREC II fuel cladding incorrectly identified the bounding parameter and inadequately considered loads induced by differential thermal expansion between the fuel and the cladding, and therefore the margin may be less than is indicated in the DSA.
E-2	There are important gaps in the configuration management program, and compensatory measures generally are lacking; corrective actions for the previous Independent Oversight configuration management finding have not been fully effective; and SNL has not yet established a DOE-approved plan with milestones for full implementation of DOE Order 420.1B, *Facility Safety*.
E-3	The implementation of the safety software quality assurance requirements of DOE Order 414.1C have not been adequately defined, and a schedule for the full implementation of those requirements at Technical Area V nuclear facilities has not been established.
E-4	Multiple instances were identified at Technical Area V nuclear facilities of failure to appropriately document identified quality problems, evaluate their cause, develop and implement corrective actions to prevent recurrence, and track their status to closure, as required by 10 CFR 830.122 and DOE Order 414.1C, Criterion 3.
E-5	Several instances were identified of work performed at Technical Area V nuclear facilities using inadequate or unapproved procedures or without adequate controls, which does not meet the requirements of 10 CFR 830.122, and DOE Order 414.1C, Criterion 5.
E-6	The Technical Area V cognizant system engineer program required by DOE Order 420.1B has not been fully implemented according to the schedule specified in the DOE-approved Maintenance Implementation Plan, and there is no definitive commitment for full implementation.
F-1	SNL has not effectively developed and implemented a process to ensure that chemicals used on site by construction subcontractors are adequately identified and reviewed to ensure that they do not present an exposure hazard to individuals near the construction area, as required by 29 CFR 1926.59 and 29 CFR 1910.1200.

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