

Volume I Summary Report



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

Sandia National Laboratories



May 2005



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

Table of Contents

1.0 INTRODUCTION	1
2.0 POSITIVE ATTRIBUTES	3
3.0 WEAKNESSES	6
4.0 SUMMARY ASSESSMENT	9
5.0 CONCLUSIONS	13
6.0 RATINGS	15
APPENDIX A - SUPPLEMENTAL INFORMATION	17
APPENDIX B - SITE-SPECIFIC FINDINGS	19

Abbreviations Used in This Report

ACRR	Annular Core Research Reactor
CBDPP	Chronic Beryllium Disease Prevention Program
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EMS	Environmental Management System
ES&H	Environment, Safety, and Health
FMOC	Facilities Management and Operations Center
GIF	Gamma Irradiation Facility
ISM	Integrated Safety Management
MESA	Microsystems and Engineering Sciences Application
NE	DOE Office of Nuclear Energy, Science and Technology
NNSA	National Nuclear Security Administration
OA	DOE Office of Independent Oversight and Performance Assurance
PEP	Performance Evaluation Plan
PETL	Processing and Environmental Technology Laboratory
PISA	Potentially Inadequate Safety Analysis
PPE	Personal Protective Equipment
SNL	Sandia National Laboratories
SSO	Sandia Site Office
TA	Technical Area
USQ	Unreviewed Safety Question
Z Machine	Z Pulsed Power Reactor

OVERSIGHT

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) inspected environment, safety, and health (ES&H) programs at DOE Sandia National Laboratories (SNL) during March and April 2005. The inspection was performed by the OA Office of Environment, Safety and Health Evaluations. OA reports to the Director of the Office of Security and Safety Performance Assurance, who reports directly to the Secretary of Energy.

Within the DOE, the National Nuclear Security Administration (NNSA) has line management responsibility for SNL. NNSA provides programmatic direction and funding for most nuclear weapons stockpile management, research and development, facility infrastructure activities, and ES&H program implementation at SNL. The DOE Office of Nuclear Energy, Science and Technology (NE) has programmatic responsibility for SNL's Annular Core Research Reactor (ACRR). At the site level, the NNSA Sandia Site Office (SSO) has line management responsibility for SNL. The NNSA Service Center provides support to SSO in several areas (e.g., legal, human resources, and employee concerns) and may provide technical ES&H specialists to support SSO. Under contract to DOE, SNL is managed and operated by Lockheed Martin, which has operated SNL since 1993.

The primary mission of SNL is research and development in support of national security and the NNSA stockpile stewardship program. SNL's mission areas include: nuclear weapons; nonproliferation and assessments; military technologies and applications; energy and infrastructure assurance; homeland security; and science, technology, and engineering. SNL has major facilities in Albuquerque, New Mexico, and Livermore, California. This OA inspection focused exclusively on the SNL facilities in New Mexico.

SNL activities involve various hazards that need to be effectively controlled. These hazards include exposure to external radiation, radiological contamination, high explosives, beryllium, hazardous chemicals, and various physical hazards

associated with facility operations (e.g., machine operations, high-voltage electrical equipment, pressurized systems, and noise). Significant quantities of radioactive materials and hazardous chemicals are present in various forms at SNL.

The purpose of this OA inspection was to assess the effectiveness of ES&H programs at SNL as implemented by Lockheed Martin under the direction of SSO. OA used a selective sampling approach to evaluate a representative sample of activities¹ at SNL, including its management systems, programmatic research and development, facilities operations, maintenance, construction, and engineered safety systems. Specifically, the sampling approach was used to evaluate:

- SNL² implementation of the core functions of integrated safety management (ISM) for selected activities, including programmatic work activities at the Processing and Environmental Technology Laboratory (PETL), Z Pulsed Power Accelerator (Z Machine), and Gamma Irradiation Facility (GIF); maintenance; and construction work performed primarily by subcontractors. OA focused primarily on implementation of ISM at the facility and activity/task levels.
- NNSA, SSO, and SNL feedback and continuous improvement systems and selected aspects of management roles, responsibilities, and authorities.

¹ In this report, the terms "activity" and "activities" are used in a manner consistent with DOE Policy 450.4, *Safety Management System*, to include programmatic activities, such as operation of the Z Machine, and all lower-tier work activities and tasks, such as specific laboratory activities or tasks performed by researchers or maintenance personnel.

² Consistent with common practice, the term "SNL" is used to refer to both the physical facility and the onsite contractor management. The term "Lockheed Martin" is used to refer to the Lockheed Martin management that provides corporate direction to the onsite SNL management team and that performs corporate line management and evaluation functions for Lockheed Martin activities at SNL.

- Functionality of essential safety systems that are designed to prevent and mitigate accidents at the GIF, including containment barriers, ventilation systems, and supporting systems and components.

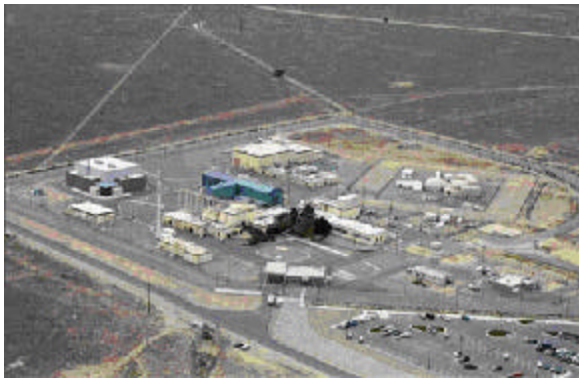


GIF Building

- SSO and SNL effectiveness in managing and implementing selected aspects of the ES&H program that OA has identified as focus areas, including hoisting and rigging, safety systems oversight, the Chronic Beryllium Disease Prevention Program (CBDPP), implementation of DOE Order 450.1, *Environmental Protection Program*, and selected aspects of safety in protective force training. OA selects focus areas—areas that warrant increased attention across the DOE complex—based on a review of operating events and inspection results.

Sections 2 and 3 provide a discussion of the key positive attributes and weaknesses identified during this review. Section 4 provides a summary assessment of the effectiveness of the major ISM elements reviewed on this inspection. Section 5 provides OA’s conclusions regarding the overall effectiveness of NNSA, SSO, and SNL management of the ES&H programs. Section 6 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.

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



Annular Core Research Reactor

Several positive attributes were identified in ES&H implementation at SNL. Engineering controls are used in a number of areas to ensure safety, and there are noteworthy aspects of the SNL pollution protection approach.

PETL has many design features that enhance safety and reduce worker exposures to hazardous materials. PETL is a new facility that was designed with substantial input from both SNL line management and ES&H personnel. The facility design incorporated a number of engineering controls that are intended to reduce worker exposures to hazardous materials. Lessons learned from the inadequacies in the older SNL research laboratories were identified and evaluated, and new design concepts were incorporated into PETL. Some of the unique design features at PETL that reduce the risk of researchers being exposed to hazardous materials and operations include a central gallery for delivery and removal of chemicals, chemical-free zones adjacent to laboratories in which technologists may work, and one-time, pass-through air in all laboratories. In addition, most fume hoods have automatic sash adjustments and ventilation flow indicators and/or alarms to ensure the proper air flow. Local ventilation systems are used extensively to control hazardous emissions and tested routinely to verify proper operation of safety interlocks and local ventilation exhausts.

GIF appropriately relies on the extensive use of engineering controls to mitigate potential radiological hazards posed by operations. The irradiation cells and pool are

heavily shielded, and numerous engineering features, such as door interlocks, warning lights and sirens, ventilation systems, and radiation monitors, have limited the need for administrative controls and personal protective equipment (PPE) during many GIF operations. While significant quantities of cobalt-60 are used to deliver very high dose rates for experiments, extensive use of radiation shielding and engineered safety features are effective in preventing personnel from being exposed to significant external radiation hazards in the GIF.



GIF Safety Door

Z Machine extensively uses procedures and other technical work documents to effectively control most activities. Technical procedures and other technical work documents 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 most hazard controls not otherwise covered by permits. For example, electrical hazard controls, such as grounding instructions and lockout/tagouts, are extensively addressed by technical procedures.

The Facilities Management and Operations Center (FMOC) has increased the use of job site hazard evaluations, and established thresholds for their use in maintenance activities. The job site hazard evaluations are being performed more frequently now because FMOC has established requirements for their use in specific cases. Approximately 250 evaluations have been performed since September 2004, many of which are for beryllium and/or radiation hazards. They are required when the work might involve chemical or biological agents, asbestos, environmental restoration sites, radiological operations/spaces, or other non-standard industrial hazards.

SNL performs extensive industrial hygiene monitoring for noise at the live-fire range, and the results have been analyzed for all existing and new weapon systems used by the SNL protective force. The SNL protective force recently transitioned to new weapon systems that have a higher decibel level. Correspondingly, SNL increased their attention on noise sampling and incorporated some noise monitoring techniques that are more appropriate for live-fire ranges (e.g., focusing on measuring impulse levels rather than sustained sound levels). SNL also recently (February 2005) approved a new guideline for protective force hearing conservation that clearly outlines the hazards and controls associated with impact and impulse noise resulting from firearms and pyrotechnic devices used during training exercises and qualification examinations.

The Microsystems and Engineering Sciences Application (MESA) Project has implemented a rigorous policy for wearing protective gloves. Implementation of this glove policy required all individuals conducting hands-on work to be wearing gloves specifically suited to the task (e.g., Kevlar® glove liners under leather gloves when handling sharp materials, or appropriate, snug-fitting protective gloves when conducting fine or detailed hands-on work). This additional PPE requirement has resulted in a decrease in hand injuries and reduced the severity of injuries that have occurred. It has also gained acceptance by the workforce, as the construction contractors have embraced the requirement and made the appropriate glove type and fit available to workers.



Sandia Waste Operations

SSO and SNL are effectively performing the actions necessary to implement an environmental management system (EMS), and their pollution prevention program includes several noteworthy practices that have resulted in several awards. SNL actions to implement the EMS are on schedule to meet the December 31, 2005, DOE order milestone and include: forming a corporate team to lead the preparation of an EMS, identifying sitewide environmental aspects and goals, communicating EMS expectations to the public and internal managers, working with SSO and SNL representatives to exchange ideas and resolve problems, and assisting individual divisions to set and achieve their environmental goals. Several aspects of the SNL pollution prevention program, which is an integral element of the EMS, are noteworthy practices. For example, SNL built a construction/demolition recycling center to recycle construction waste and plans to establish a construction specification to mandate construction waste recycling. SNL line managers directly support waste reduction goals and pollution prevention projects, and SNL has received numerous pollution prevention awards, including the White House Closing the Circle Award.

SNL is using its analysis of assessment findings, injuries, and illnesses to identify systemic and institutional issues and drive development of focused corrective and preventive actions. SNL has recently implemented formal processes at the institutional level and within the ES&H Center to routinely screen assessment and other safety performance data to identify repetitive findings that reflect broader weaknesses in processes or performance. Issues identified through these screening

processes or by management are then input to a management process to evaluate causes and develop corrective/preventive actions that are tracked to closure in formal tracking systems. For example, SNL performed a detailed analysis of ergonomic deficiencies, which constitute a large portion of SNL occupational recordable injuries, and established a focused, structured, action plan to reduce repetitive motion injuries.

SSO management initiatives are improving SSO oversight processes. In a number of areas, such as the EMS and protective force training, SSO has been actively involved in monitoring program effectiveness and providing direction. SSO is also devoting significant attention and resources to effectively implementing the relatively new requirements for oversight of essential safety systems. SSO also has a new senior management team and has hired new staff who have the needed expertise and experience. Recognizing that SSO oversight has significant weaknesses, the new management is taking a number of appropriate steps to develop and implement an effective oversight program, including placing emphasis on developing good site office procedures and using the performance evaluation process to drive contractor improvements. SSO has established an effective process to formally communicate ES&H performance issues to the contractor through the annual Performance Evaluation Plan (PEP). Joint

performance review teams, comprised of SSO and SNL subject matter experts, meet quarterly to discuss progress, issues, and areas of attention. Issues are formally tracked, and corrective actions are developed. Review of quarterly and annual PEP results indicates that SSO is effectively using this mechanism to communicate ES&H issues to the contractor. SSO also has taken positive steps through the PEP to address SNL performance concerns and increase accountability for ES&H performance at SNL. For example, as a result of longstanding issues with inadequate contractor submittals of safety basis documents, SSO has included more specific milestones within the PEP directed at improvement of quality and timeliness of submitted safety basis documents, and performance deficiencies are reflected in the PEP ratings. SSO also has made progress in formalizing its ES&H assessment program and in scheduling and conducting assessments. SSO's recent ES&H assessments of contractor performance provided an effective evaluation of programs and performance in such areas as work planning and control, and feedback and improvement. Most of these assessments were conducted with sufficient rigor and identified contractor performance deficiencies that were consistent with some of the results of areas reviewed during this OA inspection. Although much work remains, the initial efforts show potential and are appropriate to address the longstanding weaknesses in the SSO line oversight program.

Although some aspects of ISM at SNL are effective, there are weaknesses in safety systems and in the implementation of hazards analysis and control processes that protect workers from industrial and chemical hazards. There also are weaknesses in feedback and improvement processes that have hindered corrective actions.

Work descriptions, hazards identification and analysis, and hazard controls have not been sufficiently documented at the activity/task level to ensure that risks to workers have been adequately identified, analyzed, and controlled. The SNL work control processes do not ensure that systems are in place to identify, analyze, and document activity-level hazards and ensure that adequate controls are identified and clearly communicated to the workforce. In many cases, the selection and implementation of safety controls is left to the individual worker or researcher and rely too much on the knowledge and experience of individuals rather than clear safety standards and documented hazards and controls, as required by ISM. Weaknesses are evident in the hazards analysis and control processes as applied to worker safety elements, such as confined space, use of hazardous chemicals, lead, hazards communication, and some aspects of radiation protection. Similar concerns exist with regard to some aspects of waste management, primarily waste segregation.

SNL line management has not implemented a comprehensive exposure assessment program that utilizes recognized exposure assessment methodologies, as required by DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*. SNL organizations have a number of processes for identifying, analyzing, and controlling worker exposures to chemical, physical, biological, or ergonomic hazards. However, these processes are not comprehensive, integrated, and consistently applied, and do not adequately ensure that worker exposures are sufficiently analyzed, sampled/monitored, and documented, and that the results are effectively communicated to line management and integrated into work documents. Specific concerns were

identified in exposure assessments for laboratory chemicals, epoxy, ozone, welding fumes, ultraviolet radiation, lead, and noise.

SNL line management does not have an integrated process for soliciting and evaluating ES&H expertise, incorporating safety recommendations/requirements into work documents, and ensuring that safety controls fully meet ES&H requirements. In a number of cases, line management organizations interpreted ES&H policies or requirements in a non-conservative manner or did not effectively implement a required ES&H control. In some cases, line management received relevant and valid recommendations from safety professionals on how to meet an ES&H requirement but did not adequately evaluate the recommendations or take action to implement the recommendations or suitable alternatives. Further, there are few controls, triggers, or thresholds that require line management to seek ES&H subject matter experts to evaluate a situation that has ES&H implications that might be beyond the expertise of line management organizations. In some cases, line management has not solicited ES&H input if it was not required by a site requirement document, although the ES&H input may have resulted in a more accurate analysis of the hazard or a more appropriate selection of hazard controls. As a result, there were a number of situations where hazards to workers were not adequately controlled in such activities as welding, cutting, laser operations, hoisting and rigging, and confined space entries.

Line management at Z Machine has not applied a sufficient level of rigor in analyzing radiological hazards associated with operations at the facility as necessary to meet institutional requirements and verify the adequacy of radiological controls and practices. Current radiological practices date back a number of years and are based primarily on information informally communicated between various personnel. There is a lack of documented information about expected activation products, decay times, and radiation energies for various



Scene of Excavation Event

types of Z machine “shots” to establish and verify and/or alter the basis for current radiological practices and monitoring methods. Z Machine lacks an approved, documented technical basis for the selection and use of facility radiological measuring instruments as required and has not ensured that its operations are conducted in accordance with institutional requirements related to control of activated materials. In addition, some radiological controls are not properly specified in radiation work permits or technical work documents as required.

Some safety requirements are not implemented effectively for construction work at SNL. SNL has included appropriate ISM requirements for defining work in construction subcontracts but has not provided sufficient guidance and direction to ensure fully effective implementation of these requirements. Some subcontractors have not established appropriate systems for defining work, analyzing hazards, and establishing controls, particularly for health hazards. The systems in place have not always been effectively implemented. A number of required controls have not been implemented for construction projects. SNL has not imposed some of the worker safety requirements from DOE Order 440.1A on its construction subcontractors, and subcontractor processes for specifying controls have not been rigorously implemented. Many work requirements that were clearly defined in work control documents were not followed. The number and nature of these observations indicate that expectations for compliance may not have been clearly conveyed by subcontractor management.

Several waste management activities that have not been implemented effectively could impact compliance with SNL and external waste management requirements. SNL does not always ensure segregation between regulated and non-

regulated waste; in some cases, containers labeled as hazardous waste are used to collect both waste streams. Subsequently, waste management personnel, who are removed from the point of generation, make a determination about whether materials are hazardous waste or suitable for non-regulated disposal. In addition, polychlorinated biphenyls (PCBs) are not being managed in accordance with requirements for labeling and length of storage, and a satellite accumulation point is not being effectively managed to ensure compliance with site requirements that reflect external regulations.



Excavation Event Involving a Water Pipe

SNL engineering analysis and configuration management programs are not implemented with the rigor and formality expected for a DOE nuclear facility. The review of the current ACRR documented safety analysis (DSA) identified several potential discrepancies that need to be further evaluated and resulted in invoking the potentially inadequate safety analysis (PISA) process. One key area for review is the lack of safety designations for the pool liner, reactor piping, and control rod systems. At GIF, a safety-significant design deficiency was identified with respect to the capability of the elevators to lower the radioactive source fast enough to preclude worker exposure. The GIF DSA had numerous significant deficiencies, including inadequate classification of several structures, systems, and components that performed safety-significant functions; missing or inadequate analyses and supporting calculations; and miscellaneous other technical discrepancies. Although some elements of configuration management were beginning to be established, the overall configuration management program at the GIF is weak. Programmatic deficiencies were identified in many areas. Procedures were not in place for such fundamental activities as generating design modification packages and performing

replacement item equivalency evaluations. Document control processes were not established that would allow reliable and efficient identification, retrieval, and control of facility historical documentation. Several examples were found where configuration control had not been adequately maintained. The unreviewed safety question procedure contained numerous discrepancies that rendered its use problematic. Personnel did not demonstrate a full understanding of expectations for an effective nuclear safety configuration management program.

SNL has not yet established and implemented a robust self-assessment program, with sufficient line participation and accountability or with sufficient focus on observing work activities/tasks and line implementation of ES&H programs and on the attributes of ISM. Assessment activities are not consistently rigorous to effectively evaluate safety processes and performance. Line self-assessments are generally limited to periodic walkthrough inspections of the physical condition of facilities by managers and ES&H subject matter experts. Line organizations are not performing functional area assessments as directed by SNL management, except for regulatory-driven topical assessments. The corrective actions to the 2003 OA inspection finding regarding self-assessment were not timely or effective in improving performance.

SSO and SNL have not yet established a robust, consistent, effective program to consistently and rigorously document, prioritize, and evaluate ES&H deficiencies and develop effective corrective and preventive actions that are timely, tracked to completion, and validated as effective. These process and performance weaknesses were observed in a variety of SNL programs and processes, including injury and illness investigations, construction safety deficiency notices, and various ES&H reporting and corrective action tracking systems. Many of the deficiencies in corrective action management that were identified in the 2003 OA inspection report have not yet been addressed by SSO or SNL. SNL's corrective action plan for the 2003 OA inspection finding regarding corrective action program deficiencies was limited to establishment of processes for conducting analyses to identify and address crosscutting, systemic issues rather than addressing the broader processes for managing the resolution of identified safety deficiencies. Furthermore, SSO has made limited progress in establishing an effective issues management and commitment tracking system, and has not conducted adequate reviews of contractor corrective actions to verify closure and effectiveness in ensuring resolution of OA findings and preventing recurrence.

4.0 Summary Assessment

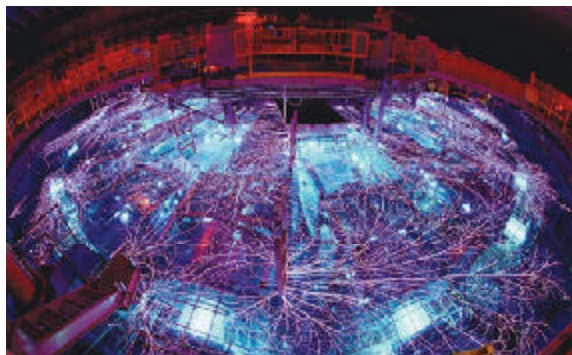
The following paragraphs provide a summary assessment of the SSO and SNL activities that were evaluated by OA during this inspection. Additional details relevant to the evaluated organizations are included in the technical appendices in Volume II of this report.



PETL Building

PETL Work Activities. Material science research and development activities/tasks within PETL are diversified and varied and are typically conducted safely by an experienced research staff that is knowledgeable of the hazards. PETL has many design features that enhance safety and reduce exposures to hazardous materials. However, there were examples when the hazards and appropriate controls were not readily apparent from the limited work descriptions, particularly for research work conducted at the experiment or bench level. In some cases, ES&H hazards have not been adequately assessed by the appropriate ES&H subject matter experts to ensure that exposures to hazardous materials are minimal and that the appropriate controls have been implemented. In a few examples, researchers have not implemented the appropriate controls as identified by the ES&H Manual, the manufacturer, or ES&H professionals, or documented and/or justified their selection of hazard controls. Much research conducted at the experiment or bench level is performed as “skill of the researcher,” without the use of activity/task-level technical work documents. Although this approach may be acceptable for some low-risk, routine research activities, it is not adequate for research activities

that may present a higher risk, or for researchers who are unfamiliar with the expected, but unwritten, hazards and controls.



Z Machine

Z Machine Work Activities. SNL has implemented the ISM process for Z Machine work, but there are longstanding and recurring implementation deficiencies that have been previously identified but not adequately corrected. Work is adequately defined, and most Z Machine hazards are adequately identified and analyzed; however, some activities are not adequately analyzed for chemical or noise exposure hazards, and radiological hazards analyses are not detailed or documented sufficiently to ensure appropriate controls. SNL has identified the appropriate hazard controls for most work activities; however, several examples of inadequate implementation of controls indicate that increased management attention is needed to ensure appropriate worker protection. Most work is performed safely and in accordance with established controls. Increased management attention is needed to address deficiencies in implementation of readiness review requirements, and workers need to increase their diligence in meeting beryllium contamination control requirements.

GIF Work Activities. The scope of work for GIF activities is generally well defined through a combination of mechanisms that include the facility primary hazard screens, GIF operating procedures, and individual experiment plans. Most hazards associated with GIF operations are also effectively identified and analyzed through

implementation of these processes. Some higher hazard activities receive additional hazards analysis through the Technical Area (TA)-V Radiological and Criticality Safety Committee. However, ozone hazards were not accurately identified in the primary hazard screen, and the effectiveness of engineering controls in mitigating this hazard inside irradiation cells was not fully determined before allowing personnel to re-enter cells after experiments. The design of the GIF facility incorporated numerous engineering controls, which significantly enhance personnel safety and limit the nature and extent of hazards and administrative controls needed during normal operations. The engineering controls are supplemented by administrative controls, such as operating procedures and radiation work permits designed to ensure safe and consistent operation of the facility. However, standard operating procedures did not specify sufficient controls for protection against ozone hazards, and implementation of some radiological control requirements at GIF has not been effective. Although little work was ongoing at the time of the inspection, the work observed at the GIF was performed safely and in accordance with established controls.

Maintenance Work. Although there have been some improvements in the use of job site hazard evaluations and primary hazard screens, there are longstanding deficiencies in activity-level hazards analysis and controls that have not been adequately addressed. Implementation of the core functions of ISM has not been driven down to the activity level for maintenance activities. From a risk management standpoint, SNL has effectively addressed some hazards (e.g., beryllium, radiation, confined spaces, elevated working surfaces), but they have not been as effective in addressing some other hazards (e.g., live electrical equipment, chemicals, hoisting and rigging). The FMOC applied ISM principles to very broad classes of workers and activities, attempting to create an umbrella under which all work could be placed. This approach fosters a sense of security in workers, supervisors, and managers that all applicable hazards are being adequately identified, analyzed, and controlled. In reality, multiple hazards exist that have not been identified and analyzed, and are not being fully controlled at the time work is performed. Although these hazards may not have immediate health effects, the potential for long-term illness exists. The heavy reliance on worker knowledge to control these hazards creates a situation in which workers unnecessarily expose themselves or others to increased risks. Worker training and skill of the craft knowledge are not sufficient to

ensure that all hazards present in the shop areas are adequately identified, analyzed, and controlled while performing work. The number and nature of hazard control deficiencies identified during this OA inspection indicate that workers are not routinely reviewing material safety data sheets and manufacturers' usage recommendations and precautions, and are not sensitive to safety deficiencies and applicable requirements.

Construction. The work control system applied to SNL construction is largely expert-based. Safety relies on experienced and skilled superintendents, foremen, and safety professionals who prioritize safety. These individuals demonstrated a good understanding of safety requirements and a strong commitment to ensuring safety. Increased assurance can be gained by instituting more formal and systematic processes of work control, consistent with the ISM policy. Formal systematic work control processes have been established for the MESA line-managed projects, and some facility-managed projects, but expectations for documenting tasks, hazards, and controls are not clear. Hazards and controls are documented in a variety of different documents, such as job hazards analyses and contract specifications. However, documentation is inconsistent and not always adequate. Expectations for consolidating hazards and controls into a single document for use by workers are not clear. In most cases, when requirements are clearly conveyed to workers, they are followed. However, the number and nature of violations of clearly defined requirements indicate the need for clarification of expectations for compliance and increased accountability. Inadequate evaluation of potential health hazards at SNL construction sites is a particular concern. Documented exposure assessments have not been performed as required by DOE orders. Contributing causes to deficiencies in this area include inadequate consideration of hazards and controls in material safety data sheets, lack of industrial hygiene expertise among subcontractors, and limited participation of the SNL industrial hygienists in the review of subcontractor work. The high number of construction activities increases the risk of a serious accident at the site. This risk, and the number of deficiencies identified by this review, indicates the need for increased management attention on construction safety.

Essential Safety System Functionality. The ACRR DSA has a number of potential deficiencies that SNL is further investigating using the PISA process. The ACRR is currently shut down, so these potential deficiencies are not an immediate risk. The essential safety systems at GIF, such as the pool, the irradiation

cells, the elevator power interrupt subsystem, and the radiation monitoring system, were generally robust, simple, and appropriately designed to perform their safety function. GIF personnel were technically capable and very knowledgeable of the facility. Most aspects of the maintenance and testing programs were adequate, and operator training and procedures were generally adequate. However, weaknesses were identified at GIF, primarily in design and configuration management. The design of the source elevator power interrupt system was inadequate with respect to the source elevator descent speed. Several structures, systems, and components were not properly classified as safety-significant in the DSA. Numerous supporting analyses were inadequate or missing. Weaknesses were identified with the configuration management program and its implementation. Weaknesses were also identified with the SNL unreviewed safety question program.

Implementation of DOE Order 450.1, Environmental Protection Program. SSO and SNL actions to implement an EMS are effective. SNL is appropriately using central environmental staff and managers, line representatives, and ES&H coordinators to develop, integrate, and implement the EMS as part of the broader ISM program. SNL implementation plans and ongoing efforts in such areas as communication and training are adequate and on schedule, and SNL has appropriate plans for performing a corporate assessment prior to self-declaration of EMS implementation. As part of EMS, SNL continues to have a proactive pollution prevention program that has achieved reductions in waste volumes and received several awards. Sustained management attention is needed to ensure that pollution prevention efforts continue to be effective under the new funding model. SSO has closely monitored SNL EMS efforts and actively participated in development efforts. However, SSO does not have a specific process for measuring and evaluating SNL performance in implementing EMS and has not identified a strategy for verifying SNL's self-declaration that ensures sufficient independence of the verification team leadership.

Hoisting and Rigging. Hoisting and rigging activities at SNL are not meeting the current DOE standards. Inspections for hand-operated hoists and miscellaneous lifting equipment are not being conducted to ensure that rigging equipment used by workers is safe. Although SNL has adopted the DOE hoisting and rigging standard, they have not issued adequate local procedures to implement the standard requirements and have not ensured that the

requirements are implemented by all construction subcontractors. Overall, hoisting and rigging by SNL personnel and subcontractors needs improvement.

Oversight of Engineered Safety Systems. SNL has not been timely or proactive in implementing DOE order requirements for a system engineer program, which includes cognizant system engineer support, and configuration management for TA-V nuclear facility safety systems. SNL did not comply with the schedule in its implementation plan for defining the program. SNL has recently initiated a concerted effort to implement the system engineer program, to include developing related configuration management procedures. However, the implementation plan is inadequate with respect to specifying the schedules for completing training and qualification of cognizant system engineers, developing system design descriptions, and establishing configuration management. SSO has also recently begun its effort to formalize and enhance its safety system oversight program, but so far has not provided adequate oversight of SNL's implementation of the system engineer program. SNL and SSO continue to exhibit weaknesses in their safety basis processes. Although both organizations are implementing corrective actions to address gaps and deficiencies, the actions are in the initial stage of development and implementation and have not yet had a positive impact on performance.

CBDPP. The program deficiencies revealed by the 2003 beryllium-related event indicate that the original development of the CBDPP did not receive sufficient SNL management attention and review. With the recent enhancements, the current SNL CBDPP and medical surveillance program are generally adequate. However, a number of ongoing corrective actions need to be monitored by SNL and SSO ES&H personnel to ensure their effectiveness and to ensure that surface-contaminated areas are properly controlled and adequately decontaminated to prevent any additional occurrences. SSO will need to follow the implementation of the specific CBDPP for the Z Machine, which was developed as one of the corrective actions for the 2003 event, especially at the activity level to assure that requirements and controls have adequately flowed to the line managers responsible for implementing the site-specific beryllium concerns.

Safety in Protective Force Training. Protective force training observed by OA was well controlled and consistent with the associated safety and health documentation. Firearms range safety and protective force training activities are effectively supported by SNL ES&H personnel. SSO and SNL audits and assessments are performed as required, and the various

SSO and SNL protective force and safety/industrial hygiene organizations communicate regularly.

SNL Feedback and Improvement. SNL has various processes for conducting the basic elements of feedback and continuous improvement. Some progress has been made in improving the formality and effectiveness of these processes since the 2003 OA inspection, including efforts to develop several long-term process tools and programmatic initiatives. However, most of the process and implementation deficiencies identified in prior OA inspections continue to exist. Line self-assessments of safety programs and performance are not rigorously planned or performed, with little observation of work or evaluation of ISM implementation. Corrective action processes are still insufficiently defined and fragmented, operational and injury and illness incidents are not rigorously evaluated, and causes and preventive actions are not being adequately identified. The root causes of feedback and improvement program weaknesses have not been identified, and thus timely, effective corrective and preventive actions have not been developed and implemented. Organizational barriers and an inadequate requirements management flowdown structure continue to impede effective and timely

resolution of longstanding deficiencies, and there is insufficient accountability for ISM implementation and performance improvement.

SSO Oversight. SSO is making progress in strengthening its site office programs and processes for SNL oversight of ES&H operations. Improvements in the ES&H assessment program, use of new SNL contractual mechanisms for evaluating SNL performance, recent new hires in key technical positions, and the new SSO senior management team are starting to positively impact SNL ES&H performance. However, many of the processes are new and have not yet fully matured, and actions are still ongoing to fully establish internal management systems and processes at the site office. SSO actions to address SNL's longstanding weaknesses in such areas as work planning and control and self-assessment through greater use of available contractual mechanisms are significant positive steps. However, weaknesses in staffing and management of corrective actions and issues continue to hinder progress in effective oversight of the contractor. In addition, the employee concerns program has not received sufficient management attention to ensure that it is being implemented in accordance with DOE orders.

SSO and SNL have established ISM systems that are conceptually sound but that are implemented with varying levels of effectiveness by line management in the various line organizations. SNL personnel are typically very experienced, and many work activities were performed with a high regard for safety. In most respects, the primary facility hazards, such as hazards associated with operation of accelerators and large radiation sources, are well understood and effectively controlled. Similarly, generally adequate controls are in place for hazards that have received higher levels of visibility and management attention, such as beryllium. Despite the design and analysis deficiencies, the GIF safety systems are generally adequate to perform their safety functions; GIF is generally operated in a safe manner because of controls in place that are not credited in the safety analysis but that are implemented adequately in practice. SSO and SNL have addressed the complex issues associated with implementing an EMS and a CBDPP, and have implemented or initiated appropriate actions to meet applicable requirements.

However, SSO and SNL have not sufficiently focused on other aspects of ISM, such as activity/task-level hazards analyses and some aspects of industrial hygiene, radiation protection, hoisting and rigging, and worker and subcontractor safety. Deficiencies in these areas were evident in a wide range of facilities and activities, including laboratory research, facility support, maintenance, construction, and waste management. Similarly, there are weaknesses in engineering analysis and configuration management, and SNL nuclear facilities are not managed with the rigor and formality expected of a DOE nuclear facility. Several important programs, such as the cognizant system engineer program, hoisting and rigging, construction contracts, and CBDPP, either did not adequately address important DOE requirements or were not effectively implemented in their initial stages, necessitating significant and accelerated corrective action efforts to address deficiencies. Collectively, the deficiencies indicate

that SNL still largely relies on an expert-based approach to safety rather than the ISM principle of clear standards and requirements, and that SNL line management has not sufficiently implemented their responsibilities for ensuring that safety processes are clearly defined and effectively implemented.

While some enhancements have been made in SSO and SNL feedback and improvement processes, many process and performance weaknesses remain in assessments, issues management, lessons learned, and injury and illness reporting at the institutional and activity levels. SSO and SNL have made only limited progress in correcting a number of longstanding and systemic deficiencies. Various internal and external assessments, including previous independent oversight inspections, have identified a number of critical issues, but SSO and SNL have not sufficiently made use of the reports and addressed and resolved the issues. Furthermore, because of weaknesses in developing and verifying corrective actions, many findings were closed before the effectiveness of the corrective actions was validated and verified. Improvements in feedback and improvement processes are key to achieving the needed improvements in safety management across SNL activities and essential systems.

Both SSO and SNL have made a number of changes in personnel and have hired some new managers and staff. SSO and SNL senior management indicated that they recognize that some corrective actions have not been timely or effective and recognize a need for improvement in this area. While much work remains, some of the recent initiatives are appropriate steps toward addressing longstanding deficiencies.

Some of the areas that warrant increased SNL management attention include:

- Enhancing worker safety and environmental protection through more rigorous hazards analysis and implementation of controls for industrial hazards and hazardous substances

- Ensuring that line management and subcontractors understand and effectively implement ES&H requirements
- Enhancing and effectively implementing hoisting and rigging requirements
- Increasing the rigor and attention to detail on safety system design analyses, DSA quality, and configuration management

- Enhancing SNL feedback and improvement processes, particularly in issues management, in the rigor and quality of assessments, and in the disciplined and effective implementation of the contractor assurance system.

SSO line management oversight also needs to focus on SNL efforts in the above areas; address weaknesses in its line management oversight of assessments, issues management, and the employee concerns program; and continue to use the performance evaluation process for evaluating and correcting contractor performance deficiencies.

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

Implementation of Core Functions for Selected Work Activities (See Appendix C, Section C.4, for a more detailed breakdown of the Core Function ratings.)

Core Functions #1-4 Implementation – PETL	NEEDS IMPROVEMENT
Core Functions #1-4 Implementation – Z Machine	NEEDS IMPROVEMENT
Core Functions #1-4 Implementation – GIF	EFFECTIVE PERFORMANCE
Core Functions #1-4 Implementation – Maintenance	NEEDS IMPROVEMENT
Core Functions #1-4 Implementation – Construction	NEEDS IMPROVEMENT

Feedback and Improvement

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

Essential System Functionality

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

This page intentionally left blank.

APPENDIX A

SUPPLEMENTAL INFORMATION

A.1 Dates of Review

Planning Visit	February 28 – March 3, 2005
Onsite Inspection	March 14-25, 2005
Report Validation and Closeout	April 5-7, 2005

A.2 Review Team Composition

A.2.1 Management

Glenn S. Podonsky, Director, Office of Security and Safety Performance Assurance
Michael A. Kilpatrick, 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 Kilpatrick	Patricia Worthington
Dean Hickman	Robert Nelson

A.2.3 Review Team

Patricia Worthington, Team Leader			
Vic Crawford	Brad Davy	Robert Freeman	Michael Gilroy
Marvin Mielke	Bill Miller	Ching-San Huang	Seth Shivaji
Bob Compton	Al Gibson	Joe Lischinsky	Jim Lockridge
Joe Panchison	Don Prevatte	Michael Shlyamberg	Ed Stafford
Mario Vigliani			

A.2.4 Administrative Support

MaryAnne Sirk
Tom Davis

A.3 Ratings

The Office of Independent Oversight and Performance Assurance uses a three-level rating system 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 three ratings and the associated management responses are:

- Effective performance, which indicates that management should address any identified weakness
- Needs improvement, which indicates a need for significantly increased management attention
- Significant weakness, which indicates a need for immediate management attention, focus, and action.

This page intentionally left blank.

APPENDIX B

SITE-SPECIFIC FINDINGS

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

FINDING STATEMENTS
1. SNL has not sufficiently documented work descriptions, identification and analysis of hazards, and hazard controls at the work activity/task level to ensure that risks to workers and the environment have been adequately identified, analyzed, and controlled.
2. SNL line management has not defined an exposure assessment strategy or implemented a comprehensive exposure assessment program that utilizes recognized exposure assessment methodologies, as required by DOE Order 440.1A, <i>Worker Protection Management for DOE Federal and Contractor Employees</i> .
3. SNL line management does not have an integrated process for soliciting and evaluating ES&H expertise, incorporating safety recommendations/requirements into work documents, and ensuring that safety controls fully meet ES&H requirements.
4. SNL procedures are not used or referenced by FMOE workers to ensure that all identified controls are followed during the course of work.
5. SNL has not assured that all construction tasks are defined in sufficient detail to support the subsequent identification of task-specific hazards and controls.
6. SNL has not ensured that construction subcontractors establish and effectively implement systems for identification and analysis of safety hazards.
7. SNL has not ensured that ES&H requirements flow down to construction subcontractors to the extent necessary to ensure compliance as required by the prime contract.
8. SNL has not ensured that hazard controls are adequately addressed in subcontractor work control documents and conveyed to the workforce.
9. SNL has not adequately ensured that its construction subcontractors comply with required controls.
10. NNSA has not clearly defined and assigned functions and activities for implementation of the employee concerns program, as required by DOE Manual 411.1.
11. SSO has not formally defined and documented nuclear safety oversight authorities and functions for NE-managed nuclear facilities at SNL, as required by DOE Manual 411.1.
12. SSO has made limited progress in establishing an effective issues management and commitment tracking system, and has not conducted adequate reviews of contractor corrective actions to verify closure and effectiveness in ensuring resolution of OA findings and preventing recurrence, as required by DOE Order 414.1B and DOE Order 470.2B.
13. NNSA Service Center and SSO have not ensured that a formal, documented program for implementing the employee concerns program has been maintained, and have not provided effective oversight of the SNL employee concerns program, as required by DOE Order 442.1A.
14. SNL has not established a program of effective assessment activities with sufficient scope and rigor to ensure that ES&H performance at all levels and in all organizations is consistently and accurately evaluated.
15. SNL has not established an effective corrective actions program that ensures that safety deficiencies are appropriately documented, rigorously categorized, and evaluated in a timely manner, with root causes and extent of condition accurately identified, and appropriate recurrence controls identified.
16. SNL injury and illness investigations lack sufficient rigor to ensure that causes are identified and appropriate and that effective corrective and preventive actions are identified and implemented.
17. At SNL, the ACRR DSA accident analysis for the seismic event with a loss-of-coolant accident is not supported by rigorous analysis that ensures acceptable safety performance for the design basis accident conditions.

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

FINDING STATEMENTS
18. At SNL, the design of the safety-significant cell source elevator power interrupt system is deficient in meeting the required DSA objective of preventing worker fatalities or serious injuries due to radiation exposure.
19. At SNL, several GIF structures, systems, and components required to prevent worker fatalities or mitigate serious injuries are not classified as safety-significant, as required by the GIF DSA.
20. At SNL, the controls established at GIF to protect workers from ozone exposure are not adequate, including inadequate DSA analyses, uncontrolled non-conservative cell ventilation system modifications, inadequate ozone monitoring during past irradiations, and an inadequate cell ventilation system design.
21. At SNL, numerous DSA analyses and/or supporting calculations required to demonstrate the capabilities of the GIF safety systems to perform their safety functions are either inadequate or not available.
22. At SNL, many of the fundamental processes and procedures for effective configuration management have not been established and implemented at the Gamma Irradiation Facility and, as a result, instances of inadequate configuration control have occurred.
23. The SNL site USQ procedure contains numerous areas where its directions are non-conservative, inconsistent, or ambiguous with respect to 10 CFR 830 and/or the DOE USQ Guide; as a result, compliance with these requirements would be problematic using this procedure.
24. SNL has not fully evaluated the GIF crane load brake issues that result from infrequent crane operation and has not developed an adequate testing and maintenance program that considers all the relevant factors needed to ensure safe and reliable crane operations.
25. SNL has not established formal GIF operating procedures to control some potentially hazardous processes, including re-entering a cell following irradiation, and using the bypass key to permit a raised elevator in a cell with the cell door open.
26. At SNL, requirements for inspection, testing, and maintenance of miscellaneous lifting devices have not been implemented in accordance with Chapter 16 of the current DOE hoisting and rigging standard.
27. At SNL, controls for the procurement, testing, inspection, and use of hand-chain-operated or manual-lever-operated hoists are inadequate to ensure that hoists are tested and inspected as required by Chapter 8 of the DOE hoisting and rigging standard.
28. The SNL implementation plan for the system engineer program requirements of DOE Order 420.1A is inadequate and has not been implemented as scheduled.
29. SSO has not provided adequate oversight of SNL's implementation of DOE Order 420.1A system engineer program requirements.