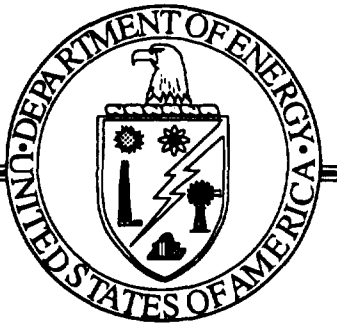
APPENDIX L

FIELD VERIFICATION REPORT
SANDIA NATIONAL LABORATORIES, NEW MEXICO
MAY 16 – 25, 1994



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EXECUTIVE SUMMARY

This report presents the results of the field verification visit at the Sandia National Laboratories, New Mexico (SNL/NM) from May 16 to May 25, 1994. This effort is part of the Chemical Safety Vulnerability Review initiated by the Secretary of Energy to assess chemical safety vulnerabilities that exist at facilities owned or operated by the Department of Energy (DOE). The overall purpose of the review is to identify and characterize weaknesses or conditions involving hazardous chemicals representing vulnerabilities at DOE facilities. Specifically, the Chemical Safety Vulnerability Review is designed to identify, characterize, and prioritize facility-specific, site-specific, and DOE-wide generic chemical safety vulnerabilities that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to chemicals, or (3) releases of chemicals to the environment.

A field verification team reviewed self-evaluation data on chemical safety vulnerabilities facing SNL/NM to gain insight into unique and generic problems that exist at DOE facilities. Ongoing activities at SNL/NM include the varied use, handling, transportation, retention, and disposal of hazardous chemicals primarily related to research and development and manufacturing activities. During the field verification review, the team concentrated its efforts on reviewing the five facilities involved in the self-evaluation effort. In addition, the field verification team also visited eight other facilities to gain a broader perspective on chemical safety programs at SNL/NM.

The field verification team noted that SNL/NM has made significant improvements in the area of chemical safety since the Tiger Team Assessment in 1991. Several programs were singled out as representing commendable practices. Other areas of excellence were also noted. Although SNL/NM management systems are maturing, there are concerns that the programs are ineffective in identifying, analyzing, and mitigating all chemical hazards because an integrated approach among different organizations is lacking. Significant weaknesses were identified in some areas associated with hazards analysis; maintenance and design engineering processes; sector-level emergency preparedness; and Environment, Safety, and Health Coordinator effectiveness that indicate a lack of overall integration. In addition, it was noted that the lack of a responsible individual who is cognizant of and has controls over all facility operations and maintenance activities in multiuser facilities was leading to significant problems associated with integrated work control and configuration management.

Commendable practices identified related to chemical safety at SNL/NM include the following:

- A "just-in-time" procurement system for commonly used chemicals,
- The Facilities Space Management Program,
- Deactivation documentation for the Light Initiated High Explosive Facility,
- The prejob planning process for the Facilities Operations and Maintenance Center,

- The use of Management Assurance Notebooks, and

- DOE Kirtland Area Office coordination and cooperation with the New Mexico Environmental Department in regulatory oversight.

The three vulnerabilities identified as a result of the SNL/NM field verification review follow, none of which represents a condition or circumstance with the potential for severe near-term consequences:

- Inadequate integrated work control of maintenance and construction activities in multiuser facilities represents a medium-priority vulnerability with a potential for short-term consequences.

- Weaknesses in, and lack of integration among, SNL/NM programs for identifying, characterizing, and mitigating chemical hazards represent a medium-priority vulnerability with a potential for short- to long-term consequences.

- Inadequate configuration management in aging laboratory facilities represents a medium-priority vulnerability with a potential for short-term consequences.

The vulnerabilities identified at SNL/NM, along with those identified at other DOE sites during the field verification phase of the Chemical Safety Vulnerability Review, will be evaluated to determine DOE-wide generic vulnerabilities. Facility-specific and site-specific vulnerabilities are made available to the sites for use in developing management response plans, which in turn will provide input to the DOE-wide management response plan.

1.0 INTRODUCTION

1.1 Purpose and Scope

Based on direction from the Secretary of Energy, the Assistant Secretary for Environment, Safety and Health established the Chemical Safety Vulnerability Working Group to review and identify chemical safety vulnerabilities within the Department of Energy (DOE). The Office of Environment, Safety and Health was designated to lead the review, with full participation from DOE line organizations having operational responsibilities. The information obtained from the review will provide the Working Group with valuable for determining generic chemical safety vulnerabilities that face the DOE complex. Identifying and prioritizing generic chemical safety vulnerabilities will enhance the Department's focus on programs, funding, and policy decisions related to chemical safety.

The Chemical Safety Vulnerability Review was designed and undertaken to identify and characterize adverse conditions and circumstances involving potentially hazardous chemicals at facilities owned or operated by the Department. Specifically, the review was designed to identify, characterize, and prioritize chemical safety vulnerabilities associated with conditions or circumstances that might result in (1) fires or explosions from uncontrolled chemical reactions, (2) exposure of workers or the public to hazardous chemicals, or (3) release of hazardous chemicals to the environment. A project plan[1] was developed, using input from line organizations with operational responsibilities, to guide the review.

This report documents activities related to the field verification visit at Sandia National Laboratories, New Mexico (SNL/NM) from May 16 to May 25, 1994. The field verification process was designed to use independent teams of technical professionals with experience in a variety of environment, safety, and health (ES&H) disciplines to verify the accuracy and completeness of the data compiled during the field self-evaluation phase of the review. The field self-evaluation phase of the review used a standardized question set developed and distributed by the Working Group to collect data related to chemical safety from 84 facilities located at 29 sites. Based on review of this input, nine sites, including SNL/NM, were chosen to participate in the field verification phase.

The review considered a broad range of facilities at SNL/NM (based on facility type and operational status), with special attention given to those facilities being transferred to, awaiting, or undergoing decontamination and decommissioning. Different types of chemical- and waste-handling facilities (i.e., laboratories, process facilities, and waste treatment and storage facilities) were visited during the review to permit identification of vulnerabilities arising from hazardous chemicals and wastes at SNL/NM. The team spent most of the time verifying data at the five facilities that were involved in the self-assessment phase of the Chemical Safety Vulnerability Review. To provide the team with a broader perspective on chemical safety vulnerabilities at SNL/NM, eight additional facilities were visited.

The SNL/NM field verification team, under the direction of a DOE team leader, was composed of DOE staff and contractor personnel with technical expertise in various aspects of chemical

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[1] "Project Plan for the Chemical Safety Vulnerability Review," dated March 14, 1994.

safety, including management, operations, training, chemical process safety, industrial hygiene, maintenance, environmental protection, and emergency management. A team composition list is provided in Attachment 1 of this appendix.

The team met with management or technical representatives from each of the facilities reviewed. Individual and small group meetings were also held, and team members conducted facility walkthroughs, document reviews, and personnel interviews to gather information related to potential chemical safety vulnerabilities at SNL/NM. The team leader met regularly with DOE and contractor management personnel to discuss the team's activities and any issues that may have surfaced. Before the field verification team left the SNL/NM site, management from the local DOE and contractor organizations conducted a factual accuracy review of the draft document. An outbriefing was conducted for DOE and contractor management on Wednesday, May 25, 1994. A draft copy of this report was provided to DOE and contractor management.

1.2 Site Description

SNL/NM is located at the foot of the Manzano Mountains adjacent to the city of Albuquerque, New Mexico. The SNL/NM facilities are about 3 miles south of Interstate 40, and about 7 miles east of downtown Albuquerque (see Figure 1). SNL/NM is operated for DOE by the Sandia Corporation, a subsidiary of Martin Marietta Corporation. Oversight of SNL/NM is provided by the DOE Albuquerque Operations Office (AL) through the Kirtland Area Office (KAO). The SNL/NM site is essentially surrounded by Kirtland Air Force Base (KAFB), and DOE has 1- to 5-year land-use permits for some Air Force property. An area of the Manzano Mountains east of KAFB has been withdrawn from the Forest Service for the exclusive use of the Air Force and DOE.

SNL/NM is a multiprogram laboratory, organized into three areas of support: (1) defense programs, (2) energy and environment, and (3) work for other Federal agencies. Specific research applications in which SNL/NM is involved include (1) advanced manufacturing technologies, (2) technical contributions to the space program, (3) information systems, (4) transportation systems, and (5) health care. There are about 10,000 DOE, operating contractor, and subcontractor personnel at the site.

SNL/NM has 546 major buildings, totaling 4.6 million gross square feet. Operations are conducted in six locations, called Technical Areas I, II, III, IV, and V, and the Coyote Test Field. Technical Area I is for administration, site support, technical support, component development, research, energy programs, microelectronics, defense programs, and exploratory systems. Technical Area II was established for the casting and assembly of chemical, high-explosive main charges for nuclear weapons, and is now used for testing explosive components. Technical Area III is devoted to testing and simulating a variety of natural and induced environments; it includes two rocket-sled tracks, two centrifuges, and a radiant-heat facility. Technical Area IV is a remote research location for pulsed power sources such as x-ray, gamma-ray, particle-beam fusion, and accelerators, all of which are used to simulate nuclear weapon effects and to conduct research on inertial-confinement fusion and

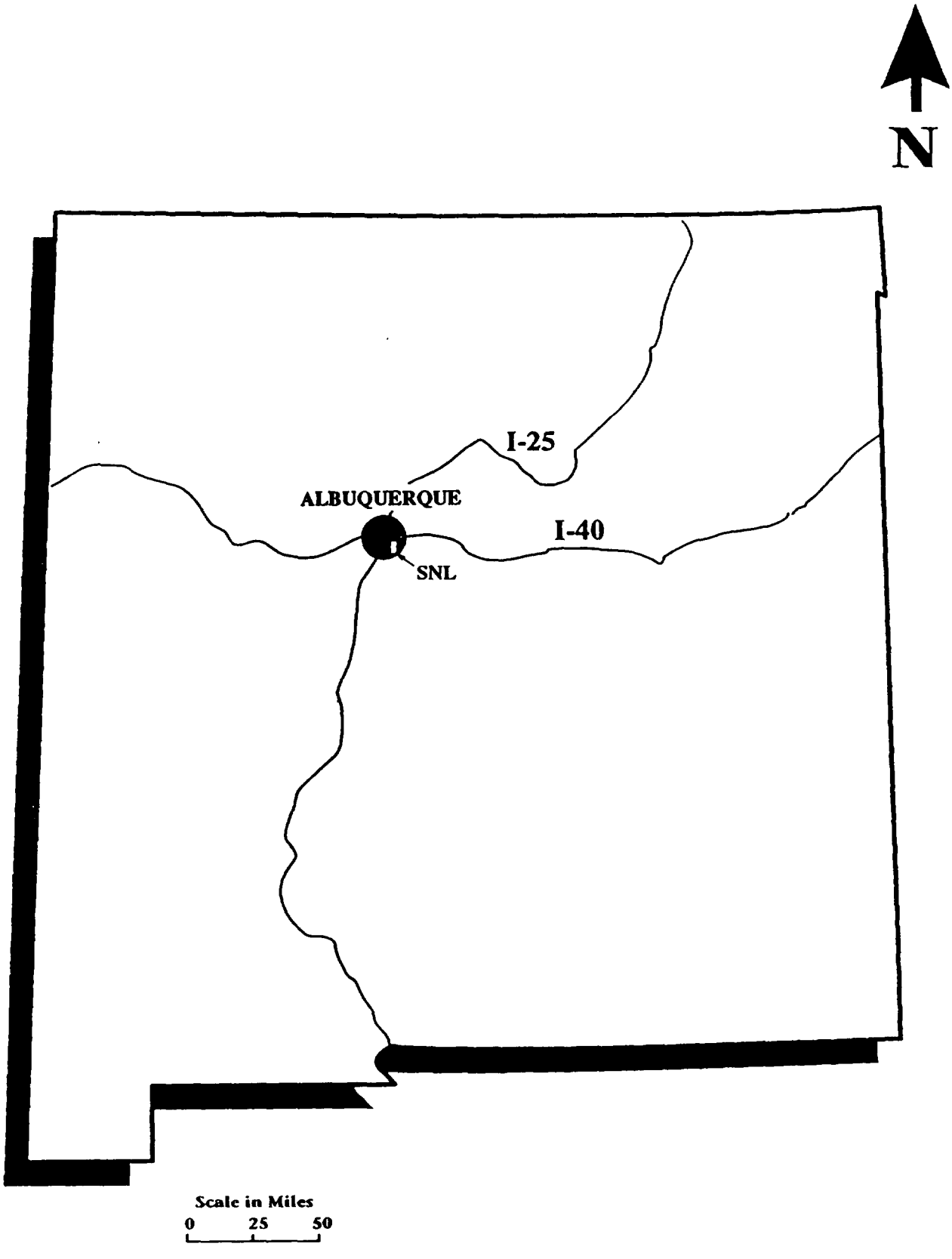

Figure 1. SNL/NM Location

particle-beam weapons. Technical Area V is the remote research area where experimental and engineering nuclear reactors and some particle accelerators are located. The Coyote Test Field contains testing operations requiring large land areas and unusual terrain, with facilities separated by large buffer zones. Facilities include explosively driven shock tubes, aerial cable sites for high-speed impact tests to a ground target, a test site where large amounts of cased conventional explosives can be detonated, numerous small explosive sites, igloos for the storage of explosives, and a laser strain seismometer.

1.3 Facilities Visited

Visiting every DOE facility at SNL/NM was not possible under the time constraints of this review. As a result, the field verification team focused its efforts to achieve the maximum results possible in the time available. Operations selected for field review focused on facilities involved in the SNL/NM self-evaluation. These included the Microprocessor Development Laboratory (MDL), Building 858; Laboratory Facilities in Buildings 805, 806, and 807; the Advanced Manufacturing Process Laboratory (AMPL), Building 878; the Hazardous Waste Management Facility (HWMF), Building 958; and the Light Initiated High Explosive Facility, Building 6715 (see Figure 2). All buildings are in Technical Area I, except for the Light Initiated High Explosive Facility, which is in Technical Area III. In addition, eight other facilities were visited by the field verification team, including the Centrifuge Facility, Building 6526; the Facilities Operations and Maintenance, Building 6587; the Lurance Canyon Burn Site; the Thunder Range Explosive Facility; the Chemical Waste Landfill; the KAFB Fire Department; the Compound Semiconductor Research Laboratory, Building 893; and the Particle Beam Fusion Accelerator II, Building 983.

The MDL, Building 858, is a microelectronics research, development, and fabrication facility. The MDL has a gross area of 243,100 square feet, a net area of 72,200 square feet, and was first occupied in 1988. The facility contains the 12,500-square-foot Class I Heavy Laboratory, 10,200 square feet of chase and service aisles, a 12,300-square-foot basement, 34,300 square feet of interstitial area, a 4,000-square-foot water plant, and 12,000 square feet of support areas. The MDL is operated by the Microelectronics and Photonics Core Competency Center.

Buildings 805, 806, and 807 are multipurpose laboratories providing bench-scale research and development activities. Building 805 has a gross area of 75,000 square feet, a net area of 48,500 square feet, and was first occupied in 1959. Building 806 has a gross area of 61,000 square feet, a net area of 38,700 square feet, and was first occupied in 1961. Building 807 has a gross area of 104,400 square feet, a net area of 48,700 square feet, and was first occupied in 1966. These buildings are used by a variety of organizations including the Research and Exploratory Technology Division, the Physical and Chemical Sciences Center, the Microelectronics and Photonics Core Competency Center, the Computational/Computer Sciences and Math Center, the Materials and Process Sciences Center, the Intelligent Systems and Robotics Center, the Energy Components and Technologies Center, the Surety Components and Instrumentation Center, the Exploratory Systems Development Center, and the Aerospace Systems Development Center.

The AMPL, Building 878, contains multiple processes, including printed-circuit fabrication, hybrid microcircuit fabrication, electronic fabrication, plastics and ceramics development,

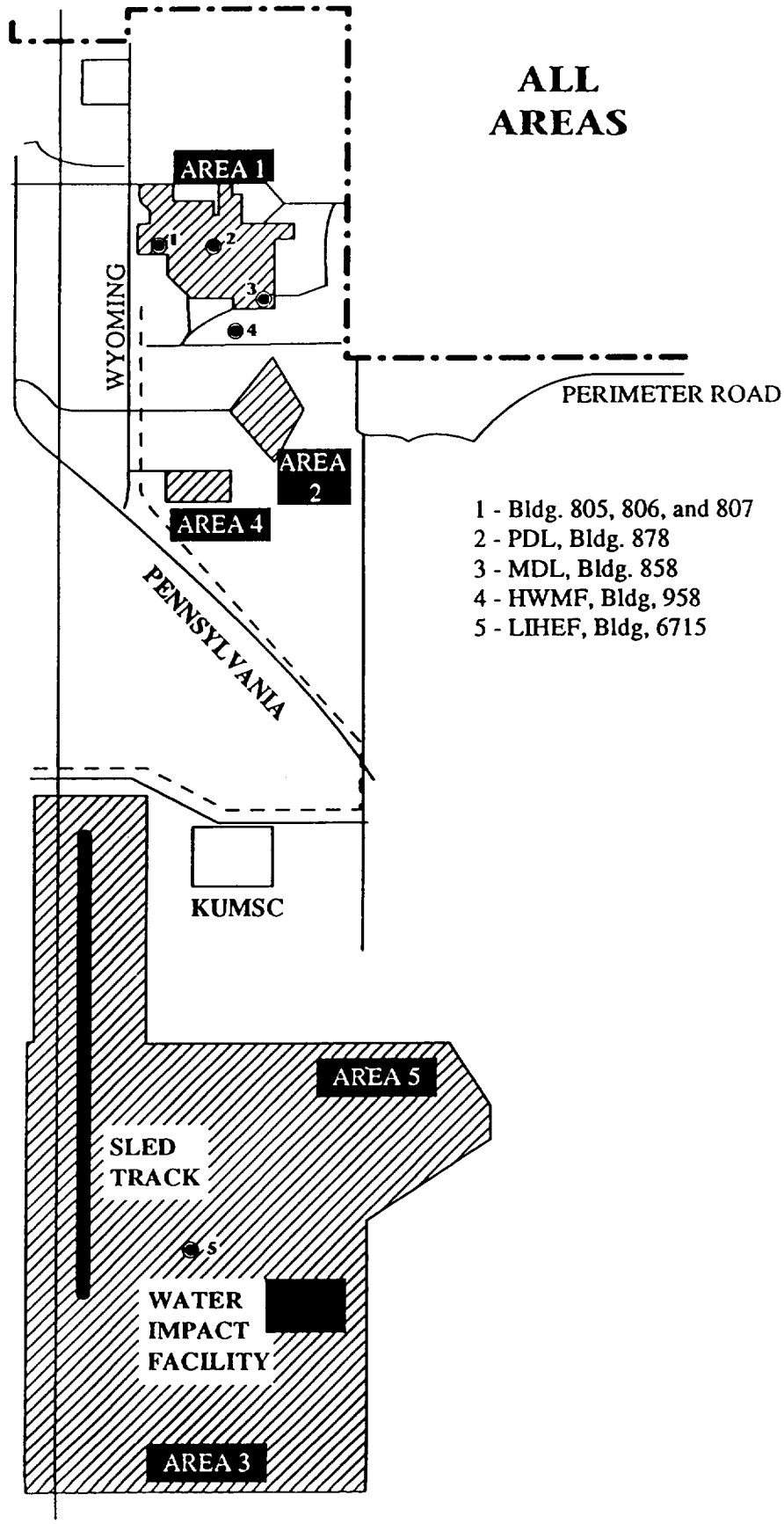

Figure 2. SNL/NM Site

machining operations, and additional support capabilities. The facility has a gross area of 137,800 square feet, a net area of 76,300 square feet, and was first occupied in 1989. The facility is occupied by the Manufacturing Technology Center, the Advanced Manufacturing Technology Center, and the Computational/Computer Sciences and Math Center.

The HWMF is the central collection point for all chemical waste generated at Sandia. Wastes are segregated into compatible Department of Transportation (DOT) hazard classes and packaged into DOT-approved containers for shipment to permitted treatment, storage, and disposal facilities. The facility has a process capacity of 750,000 kilograms per year, a gross area of 3,700 square feet, a net area of 3,500 square feet, and was first occupied in 1988. This facility is managed by the Waste Operations Department, and Rinchem, Inc., provides the packaging and shipment functions.

The Light Initiated High Explosive Facility was previously used to stimulate and study the effects of Exoatmospheric Nuclear Bursts upon nuclear weapons. The facility is currently in "inactive-partial shutdown" with an option for restart. The building has a gross area of 3,400 square feet, a net area of 2,600 square feet, and was first occupied in 1962. The facility was used by the Administrative Practices Department, the Mechanical and Climate Test Department, and the Environmental Test Department.

The Large Centrifuge Facility, Building 6526, is used to conduct acceleration tests on large and hazardous items in support of the SNL/NM broad mission of research and development. The 29-foot-radius indoor centrifuge has a 1.6 million g-lb dynamic capacity (largest of any machine in the United States). It has the capability to accelerate 16,000 pounds to 100 g, or lighter loads to nearly 300 g. A modified electrodynamic shaker mounted on the 29-foot indoor centrifuge arm permits combined vibration and acceleration testing. Items weighing up to 50 pounds can be vibrated while undergoing 50 g of acceleration.

Facilities Operations and Maintenance, Building 6587, is used by SNL/NM organization 7818, Remote Areas Maintenance, to provide electrical, mechanical, and structural support to customers in Technical Area III, Technical Area V, the Coyote Test Field, Manzano, and the Solar Power Tower. Building 6587, located in Technical Area III, has a designated 20 × 20-foot room used mainly for storage of flammable liquids, which include paint, electrical contact cleaner, and drywall cement.

The Lurance Canyon Burn Site, which has fire-testing capabilities, is used to simulate the effects of transportation and handling accidents for nuclear safety studies and for evaluating hazardous-materials shipping containers. The Burn Site conducts open-pool fire tests. Wind-shielded fire-test capabilities exist in the Smoke Emissions Reduction Facility, which is a 10 × 10-foot pool and 20 × 20-foot test chamber.

The Thunder Range Explosive Facility is a collection of several explosive firing sites. In addition to range access control and explosive storage and assembly facilities, six explosively powered shock tubes are available—varying from 2 feet to 19 feet in diameter. The largest firing site can safely accommodate fragmentation at ranges up to 3,500 feet.

The Chemical Waste Landfill, an active Resource Conservation and Recovery Act (RCRA) site opened in 1962, has received a variety of chemical wastes including mineral acids,

oxidizing agents, reducing agents, organic compounds, reactive chemicals, metals (reportedly including some radioactively contaminated beryllium), inorganic salts, and chromic acid. Six unlined pits are located in the southern portion of the Chemical Waste Landfill area. IT Corporation identified these RCRA-regulated landfill pits in their Solid Waste Management Unit report. The pits were constructed by excavating into the natural soil to a depth of about 9–10 feet. Pit 2 is divided into two separate areas for the disposal of oxidizers and reducers. Many of the wastes dumped into the old pits and trenches contained liquids. SNL/NM is currently planning to close the Chemical Waste Landfill by capping the trenches and shipping the waste containers off site for disposal.

The KAFB Fire Department provides SNL/NM with primary emergency response functions for fire, hazardous-materials events, and medical emergencies. KAFB Fire Department resources include five fire stations, 24-hour dispatch and firefighter personnel, and appropriate vehicles and equipment.

The Compound Semiconductor Research Laboratory, Building 893, performs compound semiconductor device research, including sample/device fabrication as well as Molecular Beam Epitaxy and Molecular Organic Chemical Vapor Deposition growth activities and ion implantation. The facility consists of a clean room (East and West Annexes), a light laboratory, Deionization Water Equipment Annexes, Clean Room Parts and Chemical Storage Annex, House System Equipment Annexes, a Gas Cabinet Room, a Boiler Room Annex, an Acid Exhaust Scrubber Room, and Equipment Cargo Container No. 5.

The Particle Beam Fusion Accelerator II, Building 983, is a research facility providing experimental data for use in development of fusion technology. This facility is the first superpower accelerator specifically designed for light ion fusion experiments. Operating on the principle of pulsed power, the Particle Beam Fusion Accelerator II stores electrical energy over a period of minutes, then releases it in a concentrated burst. Thirty-six identical accelerator modules converge to produce a single, extremely short, powerful pulse of energy that can be focused on a single target.

2.0 SUMMARY OF RESULTS

The field verification process was designed to verify the accuracy and completeness of the data provided to the Chemical Safety Vulnerability Working Group by the SNL/NM facilities selected to participate in the field self-evaluation process. The verification process offered an opportunity to examine any facility-specific chemical safety vulnerabilities and to make informed judgments about the seriousness of these conditions.

The goal of the field verification visit was to develop a prioritized list of facility-specific chemical safety vulnerabilities at the SNL/NM. Before arriving on site, team members reviewed the self-evaluation data and other documents to develop a list of observations related to potential vulnerabilities for their functional areas. During the onsite portion of the review, team members visited facilities selected for self-evaluation to verify reported observations and to look for other conditions or circumstances that might result in chemical safety vulnerabilities. Eight facilities that were not included in the original self-evaluation were also visited to provide the team with a broader perspective on chemical safety vulnerabilities at SNL/NM.

To facilitate effective team management and to expedite the identification of vulnerabilities across a wide range of disciplines associated with chemical safety, the field verification review was organized to include five functional areas:

- Identification of chemical holdings, including the properties of chemicals located at the facility, the characterization of those chemicals, and an analysis of the inventory.

- Facility physical condition, including engineered barriers, maintenance conditions, chemical systems, safety systems, storage, monitoring systems, and hazards identification.

- Operational control and management systems, including organizational structure; requirements identification; hazard analysis; procedural adherence; maintenance control; engineering and design reviews; configuration control; safe shutdown plans; and site programs for quality assurance, chemical safety, inventory control, access control, disposal, transportation and packaging, and corrective actions.

- Human resources programs, including technical competence, staffing, training and qualifications, employee involvement, employee concerns, personnel performance requirements, and visitor and subcontractor control.

- Emergency management program, including the emergency response plan, inplant consequences, environmental issues, coordination with the community, and community right-to-know issues.

These functional areas were evaluated on the basis of lines of inquiry provided in Attachment 1 of the "Field Verification Guide for the Chemical Safety Vulnerability Review," dated April 8, 1994. Verification of the self-evaluation data was accomplished by walkthrough of facilities, conduct of interviews with management and technical personnel,

examination of facility and site documentation, and review of incident reports and other documents.

Three vulnerabilities were identified as a result of the SNL/NM field verification: (1) inadequate integrated work control of maintenance and construction activities in multiuser facilities; (2) weaknesses in, and lack of integration among, SNL/NM programs for identifying, characterizing, and mitigating chemical hazards; and (3) inadequate configuration management in aging laboratory facilities.

Commendable practices identified related to chemical safety at the SNL/NM include (1) a "just-in-time" procurement system for commonly used chemicals, (2) the Facilities Space Management Program, (3) the Light Initiated High Explosive Facility deactivation documentation, (4) the Facilities Operations and Maintenance Center's prejob planning process, (5) the use of Management Assurance Notebooks, and (6) KAO coordination and cooperation with the New Mexico Environmental Department in regulatory oversight.

Overall, it was the field verification team's opinion that the SNL/NM self-evaluation document provided a fair and thorough representation of conditions at the five facilities involved in the effort. Several minor inconsistencies in the self-evaluation were resolved between the field verification team members and SNL/NM personnel. With help from AL, KAO, and SNL/NM personnel, the field verification team was able to provide additional insight on chemical safety vulnerabilities at SNL/NM. The following sections summarize the field verification team's understanding of chemical safety programs at SNL/NM. Chemical safety vulnerabilities are specified where applicable.

2.1 Identification of Chemical Holdings

Field verification of the chemical holdings functional area determined that many hazardous materials are used and stored in the SNL/NM facilities that were reviewed, with the greatest variety being in the research laboratories (Buildings 805, 806, and 807) and the largest quantities being in the MDL and AMPL (Buildings 858 and 878). Materials involved range from common acids, bases, oxidants, solvents, and maintenance products (e.g., oils, greases, paints, adhesives) to specialty organics, explosives, and toxic/pyrophoric gases. The MDL uses moderate quantities of hazardous gases (i.e., hydrogen, chlorine, phosphine, arsine, diborane, silane, boron trichloride, tungsten hexafluoride). The AMPL uses large quantities of hydrogen gas from a bulk-storage trailer. This review determined that hazardous materials are being stored and handled safely and in accord with SNL/NM corporate procedures and applicable standards; however, different levels of performance are apparent in different facilities.

Comprehensive inventory lists of chemicals are maintained, usually on a room-by-room basis, for each of the facilities reviewed. The ChemMaster data base is currently the official inventory system for SNL/NM. The inventory is based on an original physical inventory of all chemicals in the facilities and is updated annually. The major uses of this data base are for environmental reporting required by Title III of the Superfund Amendments and Reauthorization Act (SARA) and for identifying locations requiring special industrial hygiene emphasis to protect workers or to aid emergency response personnel. However, ChemMaster has major deficiencies: (1) it does not actually track hazardous materials, rather it indicates

the maximum quantities that may be in inventory; and (2) the master data base is updated only once a year. ChemMaster neither fully meets all SARA Title III reporting needs, nor can it meet all emergency response needs. A new system, the Chemical Information System (CIS), is being implemented to replace ChemMaster. The CIS, already in use at another SNL site, can track individual containers of chemicals from receipt to disposal, using a bar-code system. Most chemicals currently procured are being entered into the CIS and are being tracked. For CIS to be fully operational, a physical inventory of all onsite chemicals must be conducted, the containers bar-coded, and the chemicals entered into the system. SNL/NM personnel estimate that this activity will be completed in about 2 years, if adequate funding is received. Until the CIS is fully operational, the above-named facilities are maintaining current inventory data bases to meet their individual safety, quality, and reporting requirements. Several SNL/NM facilities have elected to provide more current information to the emergency response organization, even though this is not required by emergency preparedness procedures.

SNL/NM procedures require that all chemicals and hazardous materials be reviewed by industrial hygiene personnel before initial procurement, as described below in Section 2.3. A "just-in-time" procurement system for commonly used chemicals encourages minimization of chemical storage and decreases the likelihood of materials becoming outdated. The system also enables the site to avoid or minimize the need for central receiving, warehousing, and transporting of hazardous materials. This procurement system is judged to be a commendable practice. A materials exchange program provides a mechanism by which unopened excess chemicals can be made available to other users. The quantity of hazardous materials stored in SNL/NM facilities is reported to have decreased in recent years and is being controlled largely by management initiatives.

Each SNL/NM worker is trained in the use of hazardous materials and is informed of hazards in his or her workplace; material safety data sheets (MSDSs) are available in "Right-to-Know Centers" in the workplace. With few exceptions, hazardous materials are appropriately labeled, facilities in which these materials are used or stored are posted as required, and chemicals are stored according to procedures that specify segregation by hazard categories.

There is no program for systematically surveying all structures, components, and systems for the presence of chemical residuals at SNL/NM. Thus, there is no comprehensive inventory of chemical residues, and it is possible that unknown hazardous residues may exist in locations such as pipes, process equipment, ventilation ducts, or building structures. To address this situation, SNL/NM uses the Building Modification Hazard Assessment (BMHA) program to identify and characterize chemical hazards in facilities and to ensure protection of maintenance and construction workers and building occupants during modification activities. The program currently involves only those workspaces that are scheduled for modification. Workspaces are evaluated from records, by inspection, by radiation survey, occasionally by interviews with current and former employees, and sometimes by sampling. Not only are requirements for current work documented, but a comprehensive report (Industrial Hygiene Investigation Report) is prepared and entered into a data base for future reference. SNL/NM does not have a program to gather data systematically from long-service employees on possible chemical and radiological contamination at older facilities that are not undergoing modifications or ownership changes. It is noted that DOE guidance in this area is lacking.

The Facilities Space Management Program requires that SNL/NM facilities, when no longer needed for an existing activity, be evaluated for hazards and remediated if necessary before being transferred to other users. There is an incentive for users to clean and relinquish unneeded facilities because users are charged a space fee if they continue occupancy. The purposes of this program are to minimize the potential for exposure of workers to preexisting hazards when they move into an area, to expedite remediation of contaminated areas, and to track the presence of chemical and radiological residues. The program is considered a commendable practice. The Light Initiated High Explosive Facility, Building 6715, was evaluated and determined to need remediation before reassignment. Process equipment was removed, and the structure was extensively cleaned to remove explosive residues. These activities were thoroughly documented in written reports and video recordings that will provide information to future users regarding facility safety and condition. The thoroughness of documentation in this instance is commendable.

SNL/NM has a strong and compliant hazardous waste management program. The Laboratory is a "large-quantity generator" of hazardous waste, as defined by RCRA, and operates a permitted storage unit on site to facilitate proper waste management. Formal procedures are implemented through ES&H standards to manage the diverse wastes from the multifaceted research and development programs. Generator knowledge is the primary means for waste identification, with sampling and analysis performed as necessary. Qualified personnel review planned generation of wastes for control, minimization, and compliance with applicable laws, rules, and regulations that govern the generation, handling, storage, and final disposition of wastes. Internal audits are conducted throughout the waste-handling process, and external audits are conducted at the facilities accepting the hazardous waste. In addition, SNL/NM is addressing nearly 200 known or potential release sites in accordance with RCRA Corrective Action requirements. Procedures are in place to control activities that might unearth additional waste sites and to protect workers engaged in such activities.

SNL/NM has implemented effective programs to control emissions to air and water. Data on air emissions are updated annually. The Laboratory is initiating a more comprehensive survey of air emission points and is estimating the emission potential of each source. This is being done to comply with 1995 requirements of Title V of the Clean Air Act Amendments and the administering agency, the Albuquerque-Bernalillo County Air Quality Control Board. SNL/NM has conducted similar surveys to characterize onsite process and sanitary water wastes. Applicable wastewater permits have been obtained from the city of Albuquerque, and sampling is conducted as required. In addition, industrial areas that may affect stormwater discharges have been characterized, and a permit application has been submitted to the Environmental Protection Agency. A recently updated Spill Prevention Control and Countermeasures Plan is being implemented through formal ES&H procedures.

2.2 Facility Physical Condition

Generally, it was determined that the physical condition of facilities visited at SNL/NM was good. As identified in the SNL/NM self-evaluation, there are concerns with essential support equipment in aging laboratory buildings (i.e., Building 805, 806, and 807). Engineering and maintenance are performed in a professional manner using standards that encompass DOE Orders and appropriate national consensus standards. The facility maintenance and design-engineering processes, however, do not ensure a level of safety review, approval, and

testing that is commensurate with the consequences of failure or the chemical safety risk involved. SNL/NM has many service organizations that function independently and were found to have their own effective approach to work control. There is, however, no responsible individual who is cognizant of and has control over all facility operations and maintenance activities in multiuser facilities; this degrades chemical safety because of an absence of configuration control and work not being controlled in a fully integrated manner.

The design of facilities, systems, and equipment is controlled by SNL/NM engineering standards. These standards encompass all requirements of DOE Orders and the appropriate national consensus documents. Engineering design is performed in a professional manner and is, for the most part, consistent with the best standards of commercial industry. For chemical systems, the standards are based on chemical type (i.e., species and concentration) and service (e.g., state, temperature, pressure) and contain criteria for workmanship, qualification, and initial testing. Yet, SNL/NM engineering procedures fail to consider the specific consequences of (1) system or equipment failure; (2) risk to the public; (3) risk to workers; (4) safety significance (e.g., essential or vital systems); (5) proximity to other essential systems or heavily staffed areas; (6) impact of failure on programs; (7) levels of rigor in analyses; and (8) levels of review, verification, and approval, including those requirements for prestartup safety evaluation. Typically, these additional requirements and considerations are applied in a multilevel quality assurance program, using a "graded approach," as referenced in the DOE Orders. (See Vulnerability CSVR-SNL/NM-MO-02 in Section 3.2 and in Attachment 2 of this appendix.)

In spite of rapidly changing customer requirements and numerous modifications to its processes, SNL/NM has been relatively successful in maintaining as-built documentation for newer facilities. All new work being performed at SNL/NM is documented as individual maintenance tasks, and projects are systematically completed and closed. In the older facilities reviewed, however, there was an obvious lack of up-to-date, as-built drawings and equipment files. In an aging laboratory complex (i.e., Buildings 805, 806, and 807), some utility and ventilation systems were observed to be operating at, or slightly beyond, maximum design capacities and were reported to be experiencing higher than normal breakdown incidence rates. The self-evaluation prepared by this laboratory complex indicated that suspect indoor air quality continues to be an issue.

The equipment problems described, and the reported air quality issue in Buildings 805, 806, and 807, are the result of an inadequate configuration management program for essential building systems during numerous facility modifications. The tendency continues for these laboratory buildings to make many small-scale modification projects without adequate configuration control. These modification projects seldom carry sufficient funding to evaluate the impacts of the proposed changes on the entire utility system(s) of the laboratories involved. Individually, the impacts of a single project may be of minor significance; however, over the years, the cumulative effects has proven to be significant. The result is excessive fresh air makeup and exhaust flows and constant problems in maintaining proper air balance and airflow direction in these facilities. (See Vulnerability CSVR-SNL/NM-FM-03 in Section 3.2 and in Attachment 2 of this appendix). The problem in Buildings 805, 806, and 807 is exacerbated by the many independent tenant organizations attempting to exert control over portions of these buildings without the presence of a single responsible individual who is cognizant of and controls all facility operation and maintenance activities. To relieve these

problems, SNL/NM is planning gradually to relocate part of its ongoing hazardous chemical research to other facilities in less densely populated areas of the site, thereby reducing the ventilation and cooling requirements for this complex.

Maintenance at SNL/NM is performed by many organizations, which function independently. Facilities Operations and Maintenance operates and maintains central and building utilities, including heating, ventilating, and air conditioning; electrical power; steam; and domestic water and sewer systems. A Facilities Express organization performs quick repairs and modifications, such as minor office rearrangements and lighting installations. Operating technicians service their own process and process-support equipment. Offsite vendors provide and maintain some systems such as compressed gas, water treatment, and ultra high-purity water deionizers within SNL/NM facilities. Other organizations not associated with facilities maintenance, but with active service assignments within SNL/NM facilities, were also identified.

SNL/NM maintenance organizations appear to have adequate internal engineering support and integrate engineered requirements into their maintenance programs and work packages. All SNL/NM maintenance workers interviewed by the field verification team commented on their absolute dependence on industrial hygiene personnel to detect the presence of hazardous chemicals and to advise them of the requirements for personal protection before they breach ventilation systems and process drains.

Individually, each of the maintenance organizations was found to have its own approach to the safe control of work, including performing prejob safety evaluations, training and qualification, lockout/tagout, and use of personal protective equipment (PPE). Moreover, each approach appeared to be effective. While SNL/NM procedures specifically assign ownership of each square foot of building space to an organization, there is no responsible individual who is cognizant of and has control over all facility operations and maintenance activities in multiuser facilities. In a complex facility, several maintenance organizations may "own" and maintain equipment, and many have unrestricted access to the space. These separate maintenance organizations are required sometimes to perform independent work simultaneously. Chemical hazards are not always considered when establishing ownership boundaries. This may result in a situation where personnel are not cognizant of the chemical hazards associated with the activities and operations of other organizations. (See Vulnerability CSVR-SNL/NM-FM-03 in Section 3.2 and in Attachment 2 of this appendix.) Because facility research and development processes are complex, little detailed knowledge of the associated hazards is shared among the maintenance organizations.

The Facilities Operations and Maintenance Center's work control process for facilities maintenance is conducted under the direction of planners. Before releasing the work package, the planner first reviews the data from the work requester, then reviews such data with the appropriate facility organization to verify correctness, and finally performs a field walkdown of the work area to identify potential job hazards. Often, the planner is accompanied by the maintenance supervisor who will ultimately be responsible for performing the work. This program was judged to be a commendable practice.

SNL/NM has attempted to implement a centralized preventive maintenance program; however, the current process requires that a maintenance planner purposely query the preventive

maintenance data base to obtain specific facility listings of due or past-due tasks. Because this system is cumbersome and often provides incomplete listings, individual facility maintenance mechanics have resorted to developing and maintaining their own preventive maintenance records. No preventive maintenance task is reported to be delinquent, and there is no evidence that equipment is failing prematurely because of inadequate preventive maintenance attention. SNL/NM will soon implement a new, computerized, equipment-based work control system that will link specific systems to safety and health requirements and that will record historical equipment data and track preventive maintenance activities. SNL/NM is also considering the use of predictive maintenance techniques, such as vibration analysis, thermography, and used lube oil analysis, to warn of pending equipment failure.

In addition to reducing process chemical inventories, SNL/NM has effectively minimized inventories of maintenance solvents and has replaced many hazardous solvents with nonhazardous substitutes where possible. Maintenance workers have received appropriate training in the control and use of hazardous chemicals, including the use and care of PPE. Painters, who continue to use some hazardous solvents in their work, are given additional training. MSDSs are available near chemical storage areas.

The physical condition of the facilities and waste sites was found to be as reported in the site self-evaluations. Aside from the noted problems with aging laboratory support equipment, all chemical piping, valves, essential instruments, tankage, pressure vessels, and primary and secondary chemical containers were found to be appropriately labeled and in good mechanical condition. Likewise, secondary containments, including berms, dikes, and engineered containments, were found to be adequate and in good condition, with one exception. An active program for the removal of all single-wall underground fuel tanks at SNL/NM has been ongoing for 2 years. Some have been replaced with double-wall tanks, and only a few of the obsolete design remain. Their removal is planned in the near future.

2.3 Operational Control and Management Systems

Field verification of the operational control and management systems functional area determined that SNL/NM management has established systems that currently yield an acceptable degree of chemical safety in Laboratory operations. The industrial hygiene programs have improved dramatically in recent years. However, there are weaknesses in the overall SNL/NM management structure that affect chemical safety; moreover, deficiencies in the current hazards analysis system were judged to be a major supporting component of a chemical safety vulnerability on identifying, analyzing, and mitigating chemical hazards.

SNL/NM is organized with a modified matrix management structure that enables close interaction between personnel in different divisions and centers on specifically defined projects. This type of management structure has served the Laboratory well in achieving its research mission objectives. However, in the design, development, and implementation of integrated ES&H programs, this type of management structure can create situations that lead to potential problems requiring special management attention. An SNL/NM facility is often composed of multiple line organizations, which in turn are supported by other matrix organizational units. Although each square foot of a facility is assigned to an owner, generally there is no responsible individual who is cognizant of and has control over all facility operations and maintenance activities. This structure has created an environment in which

integrated work control is insufficient to ensure chemical safety. This environment can lead to confusion over responsibilities, and as a result, one group's actions may inadvertently affect another group. (See Vulnerability CSVR-SNL/NM-FM-01 in Section 3.2 and in Attachment 2 of this appendix.) In addition, the lack of a single responsible individual can lead to attempts by independent tenant organizations to exert control over building modifications, which may have ramifications beyond their portion of the facility. (See Vulnerability CSVR-SNL/NM-FM-03 in Section 3.2 and in Attachment 2 of this appendix.)

The SNL/NM organizational structure also complicates uniform implementation of programs that support chemical safety. As a result, programs designed to identify, analyze, and mitigate chemical hazards are not integrated, which causes them to vary greatly in quality and effectiveness. (See Vulnerability CSVR-SNL/NM-MO-01 in Section 3.2 and in Attachment 2 of this appendix.)

Examples of programs and controls necessary to ensure chemical safety that are currently not fully integrated include the following:

- Hazards analysis process,
- Facility maintenance and design engineering processes,
- Emergency preparedness sector planning, and
- ES&H coordinator effectiveness.

The SNL/NM management system calls for an assessment of the risk category of a proposed new or modified process through the preparation of a safety document determination. This determination is followed (if so indicated) by the preparation of a preliminary hazards assessment (PHA), a safety assessment, or a safety analysis report, depending on the level of the hazard determined. This process is deficient, however, in that the PHAs reviewed were not of adequate quality to ensure a total understanding of the hazards involved. PHAs represent the overwhelming majority of safety documents generated at SNL/NM. Moreover, accident analyses with defined potential consequences were not included in the PHAs that were examined. Discussions with the Risk Management & NEPA (National Environmental Policy Act) Department management revealed their awareness of the weaknesses in the program. The Risk Management & NEPA Department has proposed an enhanced and improved hazards analysis program, which will address current deficiencies. The ability to implement the enhanced program depends on the availability of additional resources. These additional resources have been requested for fiscal year (FY) 1995. Under the current situation, standard operating procedures (SOPs) supplement the PHAs in defining hazards associated with existing processes and in imposing meaningful safety-related process operating limits. As such, the SOPs can be used as a resource in upgrading the PHAs in the planned improved risk management program.

Procurement of hazardous materials is controlled by requirements cited in the *SNL Environment, Safety, and Health Manual.* In accordance with these requirements, requests for procurement of new hazardous chemicals or other hazardous materials, the use of which transcends previous experience, must be reviewed and sanctioned by Laboratory industrial

hygiene experts before the procurement request can be processed. Responsibility for ensuring that the requester is qualified and equipped to handle the new chemical safely rests with the line manager and the industrial hygiene reviewer. The exact procedure used in the review of such procurement requests varies between SNL/NM divisions and centers; moreover, circumstances are remotely conceivable under which the controls could be circumvented, and a hazardous chemical could be procured without proper verification that the requester is qualified and equipped to handle the chemical. However, the system is under constant scrutiny to eliminate such circumstances, and the likelihood that a chemical safety vulnerability would result from a lapse of adequate controls is very small.

SNL/NM management has implemented a well-structured system for reporting and investigating abnormal events. The requirements of this system are described in the *SNL Environment, Safety, and Health Manual*. The system, including features for addressing "near misses" and "lessons learned," is practiced uniformly throughout the Laboratory with good results.

AL and KAO maintain effective oversight programs of SNL/NM activities pertaining to chemical safety. Discussions with AL and KAO management personnel involved in this oversight function indicated that (1) SNL/NM has recently been appraised by AL and was found to have an industrial hygiene program that is improving but has some continuing deficiencies in hazards analysis and (2) KAO has assigned a full-time employee to monitor and review all SNL/NM safety analysis documentation. This measure is viewed by the Risk Management & NEPA Department as a positive sign of support of the SNL/NM effort to improve its hazards analysis program.

The SNL/NM industrial hygiene program has qualified industrial hygienists matrixed to each facility and to the facility engineering organization. They were familiar with the people and hazards in their assigned spaces. Despite cutbacks in funding, several initiatives are being pursued, including (1) systematic occupational exposure assessments, (2) IH-Charm (an improved data management program), and (3) the BMHA program, as discussed in Section 2.1 of this appendix.

The occupational exposure assessment program is designed to characterize each workspace annually, using the methodology of the American Industrial Hygiene Association, including the identification of homogeneous exposure groups. However, the level of effort being applied (i.e., one or two industrial hygienists who have responsibility for about 400 additional laboratories) is not sufficient to complete the initial surveys in time for the annual reassessment.

IH-Charm, an improved data management program, is a project to develop an integrated and consolidated industrial hygiene data and records management system. The Industrial Hygiene Department maintains separate data bases of sampling results, ventilation surveys, lasers, confined spaces, investigation reports, and instrumentation calibration. The IH-Charm program will (1) greatly assist in the hazards assessment process, (2) facilitate transfer of employee exposure information to medical personnel, and (3) enable response to requests for data, including those for toxicological data. Although the plan is designed to link existing industrial hygiene data bases, priority is being given to facilitating access to data that are not readily available at the present time.

Because of the increased emphasis on assessment activities, there have been fewer air samples to quantify chemical exposure in 1992 and 1993 than in recent years. However, the hazards assessment program will ensure that limited sampling resources are applied to areas with the greatest risk. In Building 858, industrial hygiene sampling is supplemented by a complex toxic and hydrogen gas monitoring system consisting of more than 100 sensors, each monitoring hydrogen or 1 of 12 toxic gases. Building 878 was evaluated extensively by a subcontractor investigating ventilation needs. During the current calendar year, extensive personnel sampling has been done in Buildings 805 and 807. The sampling results reviewed showed exposure to chemicals to be well below applicable standards. Local exhaust ventilation systems are also evaluated annually, and alarms are being installed on most laboratory hoods to alert the users to low-airflow conditions.

Despite the fact that SNL/NM has an adequate and improving industrial hygiene program, the progress has been limited by the lack of resources. In February 1994, $500,000 (about 10 percent) was cut from the FY 94 funding allocated to the Industrial Hygiene Department to provide funds for implementation of the *DOE RADCON Manual*. These cuts reduced activities designed to improve respiratory protection, to perform systematic occupational exposure assessments, and to support industrial hygiene programs.

2.4 Human Resources Programs

Verification activities for the human resources programs functional area at SNL/NM indicated that all program elements were effective and, in some cases, have demonstrated recent improvement. Specifically, the training program was found to have improved since the time of the 1991 Tiger Team Assessment, and staffing levels have increased. Annual appraisals are conducted, which include ES&H elements, and construction personnel are adequately trained before commencing work on site.

SNL/NM has developed a well-defined training program administered by the ES&H Training Department of the Human Resources Center. About 95 percent of this training is related to ES&H aspects. Some courses (e.g., Halogenated Solvents and Laboratory Spill Cleanup) are directly related to chemical safety, whereas the others cover a wide range of topics. The *ES&H Training Manual* addresses the procedure for developing a training program. A training catalog lists all courses under the jurisdiction of the ES&H Training Department. Training programs that are facility-specific are administered by a Training Coordinator for the affected facilities. Training is conducted by lecture, self-study, video presentation, computer-assisted instruction, interactive video, or a combination of these. After course presentation, examinations are administered and graded, and the answers are reviewed with the students. A review of one examination, however, revealed that the correct answers were not being reviewed with the students. In addition, some persons travel off site to receive specialized training. A list of training courses required and attended by each employee is recorded in the TIDBITS computer program. Based on review of a number of personnel training records, the training was found to be current for about 95 percent of the required courses. Some of those not current are for personnel who no longer need to complete the courses (e.g., retired or reassigned persons).

Construction personnel, who typically are transitory, receive a general employee training orientation presentation, similar to that for unescorted visitors, before they are permitted to

work. For those construction employees who are to work in a location where specific hazards exist, site-specific training is provided by the site training officer. If the construction employee were to leave for work elsewhere and subsequently return, the site-specific training would have to be repeated, because of the possibility that new hazards could have been introduced since the first training session. Records of site-specific training are provided to the construction contractor supervisor, who must ensure that persons who are working at the site are properly trained. In addition, SNL/NM construction engineers and inspectors, as well as the ES&H Coordinator, conduct spot-checks to ensure that workers are properly trained. Training for personnel performing studies as part of Cooperative Research and Development Agreements (CRADAs) is the same as for construction personnel, if they are to be on site for longer than normal escorted visits. However, site-specific training for CRADA personnel is considered to be current for the same length of time as for full-time employees.

ES&H Coordinators have been assigned to facilities throughout SNL/NM. AL and KAO have noted that some building and organizational ES&H Coordinators lack the training, experience, and/or support to perform their duties effectively. (See Vulnerability CSVR-SNL/NM-MO-02 in Section 3.2 and in Attachment 2 of this appendix.) Weaknesses noted during the verification visit that may be attributed to the lack of effectiveness of ES&H Coordinators include (1) hazards were not fully identified in some PHAs that could have been discovered during review; (2) chemicals were stored at a location more than 100 feet from an eyewash facility, shower, or other source of water; (3) excess flammable chemicals stored in a decontaminated facility and which have no identified use, have been in storage for at least 2 years; and (4) a number of chemical storage areas were found to be without the Sandia Workplace Hazard Awareness signs as required by the *SNL Environment, Safety, and Health Manual.* A *Center ES&H Coordinator Handbook* has been developed to address some of these issues.

Staffing levels were judged to be adequate to ensure that chemical safety training is addressed in the workplace. Vacant positions are filled as soon as qualified persons are available. Some managers indicated that there was a need for additional persons (e.g., the MDL where work for public corporations is expanding and a second shift is to be implemented). Maintenance of a full staff is complicated by the fact that some local manufacturing corporations are expanding their work force and have enticed SNL/NM employees to join them by offering higher salaries and overtime pay.

Contractor personnel are employed to perform many jobs at SNL/NM. These people are treated as part of the organization for whom they perform the work; their training requirements are the same as for full-time employees. Open communications on all work-related matters exist between workers and their management. Personnel are encouraged to exercise their stop-work prerogative if they perceive that their safety may be in jeopardy. Discussions with both workers and managers revealed that there is no hesitancy in communicating with management when a problem is perceived. In the MDL, communication is fostered by the frequency and structure of meetings with all personnel. The first meeting each day is with maintenance personnel who report on equipment status. A second meeting is held with process technicians and machine operators who discuss process equipment status. In addition, a staff meeting is held three times a week. Hazard Communication training, which had been presented by lectures and video tapes, is now presented using a commercially prepared interactive video program. MSDSs are present at or near the work place where chemical hazards exist.

The performance of all SNL/NM employees is appraised annually, including individual overall ES&H performance. Awards are made to personnel who have exhibited exemplary performance; this can include recognition for actions taken in the ES&H area. Chemical safety is addressed as a part of the overall safety umbrella, but is not specifically discussed.

Line management ES&H performance is aided or facilitated through a program that yields individual and unique Management Assurance Notebooks. This serves as a standard means of organizing and communicating how ES&H responsibilities are met. The Notebook is the primary repository of information documenting that management and others have fulfilled their ES&H responsibilities or identifies the location where this information can be found. Each member of management has a slightly different version of the notebook that is tailored to meet the organization's specific needs. As management level increases, the emphasis in the notebook shifts from details to summaries and metrics. The notebook is a living document, which is to be updated at least annually and when major changes occur. This program was judged to be a commendable practice.

2.5 Emergency Management Program

Verification activities for the emergency management program functional area indicated that SNL/NM has in place a comprehensive emergency management program. The documentation, resources, organization structure, training and drills, and community interface provide for response to chemical-related emergencies at both the building-specific and SNL/NM-wide levels. Program documentation is appropriate except that the quality and currency of the sector emergency plans, which contain both building-specific planning information and response procedures, do not necessarily correlate with the level of building-specific hazards.

The SNL/NM Emergency Plan is the central document that describes the overall emergency management program, and the associated Emergency Plan Implementing Procedures identify the actions necessary to implement the plan. For emergency management purposes, SNL/NM has divided the SNL/NM-controlled areas into numerous "sectors," with each sector composed of one or more buildings. An emergency plan has been developed for each sector to include building-specific planning information (e.g., floor plans, evacuation routes, chemical inventories) and the emergency shutdown procedures for building systems and equipment. Thus, sector plans are used for emergency planning purposes and for emergency actions by both building occupants and emergency responders. There is currently neither consistency of content among the sector plans nor direct correlation between the extent of hazards associated with a building and the content, level of detail, or overall quality of information provided by the respective sector plan. (See Vulnerability CSVR-SNL/NM-MO-02 in Section 3.2 and in Attachment 2 of this appendix.) Additional emergency management documents include responder-specific procedures (e.g., SNL/NM Emergency Response Team procedures and Incident Commander procedures) and varied administrative procedures.

SNL/NM emergency response facilities include a well-equipped central Emergency Operations Center, medical clinic and decontamination facility, and communications command center. Emergency equipment includes a dedicated incident commander vehicle, dedicated hazardous materials response trailer, ambulances, and various types of alarm and communications systems and PPE within individual buildings. In an emergency, a mobile incident command

post is established near the event scene by the onshift incident commander. Fire response vehicles and equipment, emergency medical vehicles, and a dedicated hazardous materials response vehicle and equipment trailer are maintained by the KAFB Fire Department.

SNL/NM has established an onshift incident commander position, staffed 24 hours per day by experienced persons trained in hazardous materials response to meet the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR 1910.120. In an emergency, the incident commander is notified by the 24-hour-per-day security dispatcher. On-call responders include the Emergency Operations Center cadre, the ES&H Emergency Response Team, security officers, the cognizant sector chief, and, during normal working hours, medical clinic staff and ambulance drivers.

During working hours, the sector chief is initially in charge of building-specific response and is supported by assistant sector chiefs and, for higher hazard buildings, by the building emergency response team. Building evacuation is initiated by fire alarm, or toxic gas alarm for higher hazard buildings, and building occupants evacuate to a predesignated assembly point for accountability. Search and rescue teams are used to sweep an evacuated building to ensure complete evacuation, because there is no system for positive accountability of building occupants. Two emergency telephone systems are used for reporting emergency events: (1) "117" is dialed to report a fire and (2) "144" is dialed to report other types of emergencies. SNL/NM is in the process of establishing a standard "911" system.

The KAFB Fire Department, in accordance with an interdepartmental agreement between DOE and KAFB, provides SNL/NM with primary emergency response functions for fire, hazardous materials events, and medical emergencies. The Fire Department's primary mission is to provide these functions to KAFB and the adjoining commercial airport. KAFB Fire Department resources include five fire stations, 24-hour dispatch and firefighter staff, and appropriate vehicles and equipment. The Fire Department maintains a copy of the SNL/NM sector emergency preparedness plans and maintains an SNL/NM building-specific information data base. Firefighters are trained in hazardous materials response to meet the OSHA requirements of 29 CFR 1910.120 and as emergency medical technicians. The senior fire official at the event scene coordinates with the SNL/NM incident commander to function within a unified incident command structure. For an event involving hazardous materials, the trained SNL/NM ES&H Emergency Response Team works in concert with the KAFB Fire Department.

Additional fire, hazardous materials, and/or emergency medical response resources are available from the City of Albuquerque Fire Department, as provided by a formal agreement. For emergency medical transportation and care, formal agreements are in place with community hospitals and a private ambulance service.

For emergency management purposes, assessment of the specific hazards related to the numerous operations and facilities at SNL/NM is evolving. PHAs are currently performed by the line organizations for the operations within their respective spaces (see Section 2.3). An integrated hazards assessment process meeting DOE 5500.3A criteria has been initiated for higher hazard facilities and the resulting documentation, a Hazards Assessment Document, recently has been completed for Building 878. Hazards Assessment Documents are to provide the technical basis for emergency management.

3.0 CATEGORIZATION AND PRIORITIZATION OF VULNERABILITIES

3.1 Criteria

A vulnerability is a weakness or potential weakness involving hazardous chemicals that could result in a threat to the environment, the public, or worker health and safety. Vulnerabilities can be characterized by physical or programmatic conditions associated with uncertainties, acknowledged weaknesses, and/or unacknowledged weaknesses in the area of chemical safety. Conditions required to create the vulnerability should either currently exist or be reasonably expected to exist in the future, based on degradation of systems and chemicals or through expected actions (e.g., decontamination and decommissioning of facility).

A vulnerability will be determined to exist if current or expected future conditions or weaknesses could result in the following:

- The death of or serious physical harm[2] to a worker or a member of the public or continuous exposure of a worker or member of the public to levels of hazardous chemicals above hazardous limits; or

- Environmental impacts resulting in the release of hazardous chemicals above established limits.

The prioritization of the chemical safety vulnerabilities is based on the professional judgment of team members concerning the immediacy of the potential consequences posed by each vulnerability and on the potential severity of those consequences. The first step in the prioritization process was to group vulnerabilities according to the timeframe in which they are expected to produce consequences. The following categories are defined for the timeframe within which the consequences are expected to occur:

- Immediate—Any chemical safety vulnerability that could result in immediate consequences.

- Short-Term—Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

- Medium-Term—Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring within a 3–10-year timeframe as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

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[2] Serious physical harm is defined as impairment of the body, leaving part of the body functionally useless or substantially reducing efficiency on or off the job.

- Long-Term—Any chemical safety vulnerability at a facility in which there is a significant chance of a consequence occurring in the timeframe greater than 10 years as a result of chemical degradation, change in mission for the facility, degradation of the containment systems, change in personnel at the facility, or other factors affecting the facility.

Vulnerabilities within each category are further prioritized, based on the severity of the potential consequences, as "high," "medium," or "low" priority. Consequences of high priority would cause death or irreversible injury or illness to workers or the public or would cause environmental damage that is irreversible or very costly to remediate. Low severity consequences would be reversible injuries, illness, or environmental damage.

3.2 Chemical Safety Vulnerabilities at the Sandia National Laboratories, New Mexico

The chemical safety vulnerabilities identified derived from the self-evaluation data and from specific observations made during the field verification process. Three vulnerabilities were identified at SNL/NM as a result of this review.

CSVR-SNL/NM-FM-01: Inadequate integrated work control of maintenance and construction activities in multiuser facilities.

In multiuser facilities, the presence of several independent process, maintenance, and construction organizations, which function independently, can lead to confusion over responsibilities. One group's actions may inadvertently affect another group. In these multiuser facilities, there is no responsible individual who is cognizant of and has control over all facility modifications and maintenance activities. This results in a lack of integration and work control and does not ensure that chemical-related work procedures are applied uniformly and are well coordinated. Overall, eight service organizations from different research and matrix support groups were identified, each of which may be involved with maintenance functions in a single facility. Although these organizations each have their own effective safety procedures, their approaches to work control vary. There was no clear indication that work is being controlled in a fully integrated manner to ensure chemical safety. As a result, it is possible for maintenance or construction activities in one area of an equipment room to have an adverse effect on activities in another area. This situation may lead to inadvertent exposure of workers to hazardous chemicals or compromise the integrity of safety equipment. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

CSVR-SNL/NM-MO-02: Weaknesses in, and lack of integration among, the SNL/NM programs for identifying, characterizing, and mitigating chemical hazards.

SNL/NM has not implemented integrated and effective programs for the identification, analysis, and mitigation of chemical hazards. The SNL/NM hazard analysis processes are sometimes inadequate because the level of vigor applied is not appropriate for the level of hazard present. Facility maintenance and design engineering processes do not ensure a level of safety review, approval, and testing commensurate with the consequences of failure or with the risk involved. Plans for the emergency preparedness sector are not always kept current and differ in quality and usefulness in a manner that does not necessarily correlate to the hazards present. It was also noted that the knowledge and effectiveness of building and

organizational ES&H coordinators vary greatly throughout SNL/NM. Possible consequences of the conditions cited above may include unrecognized hazards, less than adequate engineering and administrative controls, and a decreased capacity to respond to emergency situations, thereby potentially increasing both the probability and severity of accidents involving chemicals. These conditions and circumstances represent a medium-priority vulnerability with a potential for short- to long-term consequences.

CSVR-SNL/NM-FM-03: Inadequate configuration management in aging laboratory facilities.

Inadequate configuration management in an aging SNL/NM hazardous-chemical-containing laboratory complex (i.e., Buildings 805, 806, and 807) has resulted in the gradual degradation of essential utility and ventilation systems. These systems were reported to be operating at, or slightly beyond, maximum design capacities; experiencing a higher than normal breakdown incidence rate; and providing a contributing cause for indoor air quality issues. The chemical research laboratories undergo many small-scale modification projects that, typically, are not funded for full system engineering evaluations during the design phase. The problem is exacerbated by the many independent tenant organizations attempting to exert control over portions of the building without a responsible individual who is cognizant of and controls all facility operations and maintenance activities. As a result, there is a significant potential for the exposure of laboratory personnel to hazardous chemicals when essential ventilation and other support equipment fails in service. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

ATTACHMENT 1

TEAM COMPOSITION

Area of Responsibility	Name/Organization
Team Leader	Bradley A. Peterson Office of Performance Assessment U.S. Department of Energy
Management/Operations	Leon H. Meyer The LHM Corporation
Human Resource Programs	Woodson B. Daspit WBD Consulting Corporation
Chemical Process Safety	John A. Porter JP Techservices, Inc.
Industrial Hygiene	Linda F. Munson Evergreen Innovations, Inc.
Environmental Protection	Dale J. Dietzel Chicago Operations Office U.S. Department of Energy
Maintenance	John S. Stone ICF Kaiser Hanford
Emergency Management	Thomas A. Kevern Program Management, Inc.
Site Liaisons	Michelle D. Chavez Kirtland Area Office U.S. Department of Energy
	Kim L. Delman Albuquerque Operations Office U.S. Department of Energy
Chief Coordinator	Mary E. Meadows Environmental Management Associates
Coordinator	Norma B. Cameron Office of Performance Assessment U.S. Department of Energy
Technical Editor	Robert F. McCallum McCallum-Turner, Inc.

ATTACHMENT 2

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: May 25, 1994

Site/Facility:	Sandia National Laboratories, New Mexico
Vulnerability Number:	CSVR-SNL/NM-FM-01
Functional Area(s):	Facility Physical Condition, Operational Control and Management Systems

1. Brief Description of Vulnerability.

   Inadequate integrated work control of maintenance and construction activities in multiuser facilities.

2. Summary of Vulnerability.

   In multiuser facilities, the presence of several operations, maintenance, and construction organizations, which function independently, can lead to confusion over responsibilities, and one group's actions may inadvertently affect impact another group. In these multiuser facilities, there is no responsible individual who is cognizant of and has control over all facility operations and maintenance activities. This results in a lack of integration of work control and does not ensure that chemical-related work procedures are applied uniformly and are well coordinated.

3. Basis.

   a. Requirements:
      - DOE 6430.1A, "General Design Criteria," specifies that facility documentation be updated as modifications are made.
      - DOE 5480.19, "Conduct of Operations Requirements for DOE Facilities," Attachment I, Chapter VIII, stipulates that facilities are required to establish administrative control programs to handle configuration changes.
      - DOE 5480.10, "Industrial Hygiene," requires that the health of workers be protected.
      - DOE 4330.4B, "Maintenance Management Program," stipulates that DOE facilities be maintained such that the health and safety of all workers is ensured at all times.

   b. Chemicals Involved: This is a programmatic vulnerability relating to numerous SNL/NM facilities containing hazardous chemicals.

   c. Relevant Self-Evaluation Data: The self-evaluation did not identify any issues related to this vulnerability.

   d. Contributing Causes:
      - Procedures that define worker ownership for every square foot of facility space have been developed and implemented at SNL/NM. However, ownership boundaries are established by type and function of equipment and do not necessarily consider the nature of the chemical hazards present or the locations of hazardous chemical systems. Workers may not be aware of the chemical hazards associated with nearby equipment (including maintenance or modifications being done) if they have not been properly indoctrinated by facility management or if they have not been sufficiently inquisitive to otherwise obtain the information.
      - Several service organizations, which function independently, are allowed to work simultaneously in SNL/NM facility equipment spaces that contain hazardous chemical processing equipment and/or significant amounts of hazardous chemicals. In effect, all workers are exposed to the same potential chemical hazards, but all may not be fully aware of these hazards, particularly if they are assigned to perform nonchemical-related activities, as in the case of the utility maintenance crews.

Site/Facility: Sandia National Laboratories, New Mexico

Vulnerability Number: CSVR-SNL/NM-FM-01

Functional Area(s): Facility Physical Condition, Operational Control and Management Systems

3. Basis. (Continued)

- There is no responsible individual who is cognizant of and has control over all facility operations and maintenance activities. This has the potential to affect chemical safety negatively.

e. Potential Consequences: Because work is not controlled by a single responsible individual, there is a potential that maintenance or construction activities in one area may adversely affect activities in an adjacent area. This may result in inadvertent exposure of personnel to hazardous chemicals or compromise the integrity of safety equipment. Personnel not cognizant of all ongoing chemical processes or work activities being performed by other organizations may be exposed unknowingly to the associated hazards; thus, in the event of a process upset, equipment failure, or inadvertent hazardous chemical release, they may not be properly protected or may be unable to respond properly. These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

4. Supporting Observations.

- In the facilities evaluated, several organizations, which function independently, perform operations, maintenance, and construction activities. These organizations are assigned in a matrixed fashion either to use the facility or to service the facility or its equipment. Focusing only on the services sector, the following were found: (1) several groups within the Facilities Operations and Maintenance Center (7800) have assigned individuals to facilities to both operate and maintain the utilities equipment (e.g., electrical distribution, steam, domestic water, and sewer); (2) Center 7800 provides additional mechanics and electricians when repairs are too large or complex for the facility-assigned maintenance crews; (3) Facilities Express (7911) services facilities needing quick repair or modification (e.g., lighting installation, office rearrangement); (4) operating technicians from several user organizations maintain their own process-specific equipment (e.g., air scrubbers, toxic gas supplies, vacuum pumps, exhaust burn boxes); (5) facility users may procure offsite contractor services when needed; (6) when numerous process modifications are required, as in the installation of new tools for microelectronics development, the Manufacturing Facilities Department (7908) may provide an offsite time-and-materials contractor; (7) when facilities or systems require major modification, offsite contractors may become involved through the Program Offices (7903 and 7904); and (8) there are several vendor-owned, vendor-maintained systems located within facility equipment spaces that supply compressed gases, water treatment, and highly purified deionized water.

- Each of these service organizations has its own approach to safe work control, including prework safety assessments, training and qualification, lockout/tagout, and use of personal protective equipment. Individually, these work controls appeared to be effective. Further, personnel access to facility equipment spaces was found to be properly controlled such that only those with a need to enter are allowed to do so; however, each of the service organizations listed above could be involved simultaneously in a particular space and, thus, would have access.

Site/Facility:	Sandia National Laboratories, New Mexico
Vulnerability Number:	CSVR-SNL/NM-FM-01
Functional Area(s):	Facility Physical Condition, Operational Control and Management Systems

4. Supporting Observations. (Continued)

- Concern for the safety of workers in hazardous chemical-containing facilities arises because there is no indication that the work is controlled in a fully integrated manner by a single responsible individual who is cognizant of and has control over all facility operations and maintenance activities. It is not apparent that individual work crews are routinely warned in advance of the planned or ongoing service activities by other crews that may take place in their proximity. Further, they may not be warned of hazards, including the chemical hazards, that may be encountered as a result of the other crew's activities. In one instance, facility maintenance crews were not fully informed of the chemical hazards associated with an exhaust scrubber located directly adjacent to their ventilating systems. Thus, their only protection in the event of a serious scrubber malfunction would be their individual skills in recognizing hazards and their ability to respond in a conservative manner (in this case, building evacuation).

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: May 25, 1994

Site/Facility:	Sandia National Laboratories, New Mexico
Vulnerability Number:	CSVR-SNL/NM-MO-02
Functional Area(s):	Operational Control and Management Systems, Facility Physical Condition, Emergency Management Program

1. Brief Description of Vulnerability.

   Weaknesses in, and lack of integration among, SNL/NM programs for identifying, characterizing, and mitigating chemical hazards.

2. Summary of Vulnerability.

   SNL/NM has not implemented integrated and effective programs for the identification, analysis, and mitigation of all chemical hazards. The SNL/NM hazard analysis processes are sometimes inadequate because the level of rigor applied is not appropriate for the level of hazard present. Facility maintenance and design engineering processes do not ensure a level of safety review, approval, and testing commensurate with the consequences of failure or the risk involved. Plans for the emergency preparedness sector vary in quality and usefulness in a manner that does not necessarily correlate to the hazards present. These conditions may result in unrecognized hazards, less than adequate engineering and administrative controls, and a decreased capacity to respond to emergency situations.

3. Basis.

   a. Requirements:
      - DOE 5480.4, "Environmental Protection, Safety and Health Protection Standards," requires that DOE facilities conform to an established set of standards including the National Electrical Code.
      - DOE 5483.1A, "Occupational Safety and Health Program for DOE Contractor Employees at Government-Owned Contractor-Operated Facilities," requires heads of Field Organizations to require contractors to furnish contractor employees employment and a place of employment which are as free from occupational safety and health hazards as possible.
      - DOE 6430.1A, "Engineering Design," calls for design, verification, and test requirements relating to consequence of failure for engineering and maintenance work.
      - DOE 5500.3A, "Planning and Preparedness for Operational Emergencies," requires a hazard assessment to be prepared and used for emergency planning purposes.
      - DOE 4330.4B, "Maintenance Management Program," and DOE 5480.19, "Conduct of Operations Requirements for DOE Facilities," require that postmaintenance testing requirements be established and specified on the maintenance work order or accompanying documentation.
      - DOE 5481.1B, "Safety Analysis and Review System," establishes the DOE policy to ensure that potential hazards are systematically identified; consequences are analyzed; and reasonable measures are established to eliminate, control, or mitigate the hazards. It also establishes hazard classes. It does not effectively establish requirements for low-hazard facilities.
      - SNL/NM Emergency Plan Implementing Procedure No. 560 requires sector plans to be reviewed and updated annually by the cognizant line organization "sector chief."

   b. Chemicals Involved: A wide range of hazardous chemicals and chemical wastes are involved with different activities at SNL/NM.

Site/Facility:	Sandia National Laboratories, New Mexico
Vulnerability Number:	CSVR-SNL/NM-MO-02
Functional Area(s):	Operational Control and Management Systems, Facility Physical Condition, Emergency Management Program

3. Basis. (Continued)

c. Relevant Self-Evaluation Data: The SNL/NM self-evaluation cites identification of hazardous operations through preliminary hazards assessments (PHAs) and, when appropriate, safety assessments and safety analysis reports as a fundamental method for controlling hazardous chemicals at SNL/NM. The self-evaluation does not specifically address deficiencies in these systems.

d. Contributing Causes:
- The process used by line management, ES&H coordinators, and the Risk Management & NEPA Department for approval and review of PHAs is not effective in identifying deficiencies.
- There are deficiencies in the formal guidance for preparing safety documents.
- There are deficiencies in the qualification and training program for ES&H coordinators.
- There are deficiencies in the training program for personnel who prepare safety documentation.
- There is a lack of rigor in the conduct of engineering analysis and maintenance of potentially hazardous chemical processing systems.
- There are less than adequate controls covering the content, level of detail, or review process for sector emergency plans.
- The SNL/NM organizational structure makes uniform program implementation difficult.

e. Potential Consequences:
- The absence of an adequate hazards analysis program may contribute to the failure to recognize and mitigate hazards. Unrecognized hazards may lead to less-than-adequate engineering and administrative controls, thereby increasing both the probability and consequences of accidents involving chemicals.
- Without current and accurate sector emergency plans, emergency responders may unknowingly subject themselves to hazardous chemical exposures. These conditions and circumstances represent a medium-priority vulnerability with a potential for short- to long-term consequences.

Site/Facility:	Sandia National Laboratories, New Mexico
Vulnerability Number:	CSVR-SNL/NM-MO-02
Functional Area(s):	Operational Control and Management Systems, Facility Physical Condition, Emergency Management Program

4. Supporting Observations.

- Hazard analysis is sometimes inadequate for the level of hazard present. Chemical hazards in nonnuclear facilities are classified according to the guidance provided by KAO in a January 11, 1994, memorandum to A.O. Bendure. Under this guidance, the majority of chemical processes are classified as nonnuclear low-hazard facilities. Neither risk-based prioritization nor quality assurance levels are assigned for design, construction, or maintenance of facilities, systems, and equipment. Hazard analysis is provided in a PHA prepared by the responsible line organization, approved by line management, and reviewed by organizational ES&H coordinators and the Risk Management & NEPA (National Environmental Policy Act) Department. The line organization is responsible for an annual review and update. PHAs may cover a single process, room, or facility; there are about 4,000 PHAs at SNL/NM. Accident analyses with defined potential consequences were not included in the PHAs that were examined. Discussions with management personnel in the Risk Management & NEPA Department indicated their awareness of deficiencies in the program, which were judged to derive from a lack of clear guidance in the program documents on techniques for preparing PHAs and other safety documentation and inadequate training of the SNL/NM employees assigned the responsibility for preparing the safety analysis documents. The Risk Management & NEPA Department has proposed an enhanced and improved hazards analysis program, which will address current deficiencies. The ability to implement the enhanced program depends on the availability of additional resources.

- SNL/NM relies heavily on organizational and building ES&H coordinators to identify hazards and serve as a primary contact with the safety disciplines. AL and KAO have noted that some ES&H coordinators lack training, experience, and/or support to perform their duties effectively. The knowledge and effectiveness of ES&H coordinators vary greatly throughout SNL/NM, depending on the organizations involved—not necessarily on the chemical or other risks. SNL/NM has taken action to increase the effectiveness of the organizational ES&H Coordinators by furnishing them with the *Center ES&H Coordinators Handbook,* which lists sources of requirements and points of contact. Several deficiencies were noted that indicate breakdowns in the effectiveness of ES&H coordinators.

- For designated low-hazard facilities, facility maintenance and design engineering processes do not ensure a level of safety review, approval, and testing commensurate with the consequence of failure or with the risks involved. The design of facilities, systems, and equipment is controlled by SNL/NM engineering standards that encompass the requirements of DOE Orders and appropriate national consensus standards. The standards include criteria for workmanship and the requirements to be met for qualification and testing. SNL/NM standards do not address design requirements or considerations that relate to (1) specific consequences of failure, (2) risk to the public, (3) risk to personnel, (4) critical or vital safety systems, (5) proximity to critical or vital safety systems, (6) proximity to heavily staffed areas, (7) impact of failure on vital programs, (8) level or rigor in engineering analysis, (9) degree of review, verification, and approval, and (10) requirements for system or equipment prestartup review and approval. Customer-funded modifications may receive, but do not require, input from industrial hygienists and other safety professionals.

Site/Facility:	Sandia National Laboratories, New Mexico
Vulnerability Number:	CSVR-SNL/NM-MO-02
Functional Area(s):	Operational Control and Management Systems, Facility Physical Condition, Emergency Management Program

4. Supporting Observations. (Continued)

- A project to add a chemical storage room and an acetone distillation apparatus to Building 878 received only limited input from industrial hygiene specialists. The ventilation flow rate was designed to preclude generation of an explosive atmosphere, but there was no documentation that this flow rate was sufficient for the protection of personnel. Although no formal process hazard analysis was performed, the facility was designed in conformance with code requirements with venting panels to relieve pressure from an explosion involving up to 120 gallons of acetone. For this same project, a codes integration specialist determined that the Uniform Building Code required backup power for the ventilation system for the distillation apparatus (based on an interpretation that it was not a closed system). When backup power was found to be unavailable, the facility was designed without it, based on the understanding of a fire protection engineer that it was a closed system. No basis for the second judgment was documented, and no accident analysis covering the loss of power was performed. At the time of the review, the distillation apparatus installation had not been turned over to the operating group. If a problem is identified, there is no assurance or system to inform the operating group or DOE of the varying judgments concerning the degree of compliance.

- Maintenance standards for repairing and maintaining the facilities, systems, and equipment, including requirements and frequencies for preventive maintenance activities, are based on the specific service without consistent regard for consequence or risk. Further, the requirements for specific postmaintenance testing (e.g., to prove safety and operability before release to the line organization) are not well defined and are not risk based.

- Sector Emergency Plans vary in quality and usefulness in a manner that does not necessarily correlate to the hazards present. The SNL/NM emergency response organization and the Kirtland Air Force Base Fire Department rely on the Sector Emergency Plans for building-specific emergency planning and response information (e.g., building floor plans, location of emergency equipment, presence of hazardous materials). The plans reviewed lacked consistency in format and content and varied in length from about 20 to more than 100 pages. Not all plans had been reviewed or updated annually.

- Prioritization of ventilation projects does not always appear to be based on the risk of chemical exposure. Ventilation deficiencies in Building 878 have required six separate projects to provide recommended airflows for the present facility occupancy. Although five of these, including one to eliminate lunchroom odors in the workplace, have been given funding priority, a $40,000 project to reroute the exhaust air from a plastics curing operation (relocating the discharge from directly above a loading dock to a roof stack) was not funded. Although SNL/NM has implemented compensatory measures when this ventilation system is in use, the relative priority does not appear to be risk based.

CHEMICAL SAFETY VULNERABILITY REVIEW
VULNERABILITY FORM DATE: May 25, 1994

Site/Facility:	Sandia National Laboratories, New Mexico/Laboratory Buildings 805, 806, and 807
Vulnerability Number:	CSVR-SNL/NM-FM-03
Functional Area(s):	Facility Physical Condition, Operational Control and Management Systems

1. Brief Description of Vulnerability.

   Inadequate configuration management in aging laboratory facilities.

2. Summary of Vulnerability.

   Inadequate configuration management in an aging SNL/NM hazardous-chemical-containing laboratory complex has resulted in the gradual degradation of essential utility and ventilation systems. These systems were reported to be operating at, or slightly beyond, maximum design capacities, to be experiencing a higher than normal breakdown incidence rate, and to be a contributing cause of suspect indoor air quality issues. The chemical research laboratories undergo many small-scale modification projects that, typically, do not provide sufficient funding for full system engineering evaluations during the design phase. The problem is exacerbated by the many independent tenant organizations attempting to exert control over portions of these buildings without a responsible individual who is cognizant of and controls all facility operations and maintenance activities.

3. Basis.

   a. Requirements:
      - DOE 6430.1A, "General Design Criteria," specifies that facility documentation be updated as modifications are made.
      - DOE 5480.19, "Conduct of Operations Requirements for DOE Facilities," Attachment I, Chapter VIII, stipulates that facilities are required to establish administrative control programs to handle configuration changes.
      - DOE 5480.10, "Contractor Industrial Hygiene Program," requires that the health of workers be protected.
      - DOE 4330.4B, "Maintenance Management Program," stipulates that DOE facilities be maintained such that the health and safety of all workers be ensured at all times.

   b. Chemicals Involved: Numerous industrial chemicals, toxins, carcinogens, compressed gases, and organics, all in small laboratory quantities; mercury contamination (in laboratory drains); minor depleted uranium contamination; and low levels of other hazardous materials.

   c. Relevant Self-Evaluation Data: The self-evaluation performed by the laboratory complex indicated that indoor air quality continues to be an issue. The following concerns related to this subject were identified:
      - Fresh-air intakes are at or below grade level and are subject to the capture of vehicle exhaust gases.
      - Roof-mounted fume hood exhaust stacks on Building 805 are of insufficient height to ensure that workers are not exposed to hazardous exhaust constituents when performing routine maintenance tasks while on the roof of Building 805.
      - There is a potential microbial problem in the ventilation system of one section of these facilities.
      - On one occasion, a facility was evacuated because of suspect indoor air quality.

Site/Facility:	Sandia National Laboratories, New Mexico/Laboratory Buildings 805, 806, and 807
Vulnerability Number:	CSVR-SNL/NM-FM-03
Functional Area(s):	Facility Physical Condition, Operational Control and Management Systems

3. Basis. (Continued)

d. Contributing Causes:
- The facilities have been in use for 30 years, and essential ventilation equipment is nearing the end of its dependable operating life.
- A multitude of small-scale ventilation modifications to support the needs of the laboratory users and their customers have been made over the past several years. These relatively minor modifications have expended available ventilation system excess capacity and have resulted in excessive exhaust flow rates and significant air imbalances in the laboratories.
- Many independent tenant organizations attempt to exert influence over portions of the building without a single responsible individual having overall control.

e. Potential Consequences:
- There is a potential for exposure of laboratory personnel to hazardous chemicals when essential ventilation and other support equipment fails in service.
- Previous exhaust system failures have resulted in pressure reversals, causing not only the loss of chemical vapor control, but also the distribution of the chemical vapors to other parts of the facility.
- These conditions and circumstances represent a medium-priority vulnerability with a potential for short-term consequences.

4. Supporting Observations.

- In the aging laboratory complex (i.e., Buildings 805, 806, and 807), the assigned facility operations and maintenance crew noted that some essential utility and ventilation systems were operating at or slightly beyond maximum design capacities. Systems include (1) makeup air units for Building 805 for both heating and cooling (required to operate at full load because of the large amount of air being exhausted via chemical fume hoods and localized chemical equipment ventilation); (2) water chillers (cooling both the building spaces and an excessive number of computers, laboratory electronics and laboratory processes) for Buildings 805, 806, and 807; (3) chilled-water circulation pumps for Buildings 805, 806, and 807; and (4) most fume hood exhaust systems, each of which serves two or more laboratory rooms. Severe operating demands, in combination with almost 30 years of operating service, have significantly reduced the equipment availability (i.e., time available for dependable operation) of these essential systems.

- The self-evaluation report provided by this laboratory complex indicated that suspect indoor air quality was, and continues to be, an issue. In the past, there have been building evacuations due to suspect air quality. This is further illustrated by verbal reports from the assigned maintenance crew: when chemical hood exhaust fans fail (e.g., overload, overheat, failed drive belts), they often coast in reverse rotation. This phenomenon indicates a pressure reversal in the associated fume hoods, allowing potentially hazardous chemicals to escape into laboratory spaces, flowing through hallways to other laboratories with operating exhaust fans.

Site/Facility: Sandia National Laboratories, New Mexico/Laboratory Buildings 805, 806, and 807

Vulnerability Number: CSVR-SNL/NM-FM-03

Functional Area(s): Facility Physical Condition, Operational Control and Management Systems

4. Supporting Observations. (Continued)

- The problems described are symptomatic of inadequate engineering configuration management (i.e., "as-built" documentation) programs and of the tendency for chemical laboratories to require many small-scale modification projects. Such projects usually have insufficient capital resources to allow for performance of formal analyses of entire ventilation systems to determine the effects of the proposed changes on air and heat flows, on static pressures, and on the resulting air balances (direction and velocity of flow that directly affect air quality). The problem illustrated is further compounded in that Buildings 805, 806, and 807 have many independent tenant (customer) research organizations with unrelated budgets and rapidly changing missions in unrelated fields. Further, the three connected facilities received little or no "as-built" attention in their early operating lives; thus, there is an inadequate baseline for engineering analysis.

- Facilities design engineers revealed that, because of multiple organizations controlling different parts of the building, the potential exists for different design groups to be performing concurrently two (or more) modification projects for the same ventilation system without interface or knowledge of the other's work. This situation results from the fact that projects are funded from separate customer organizational research budgets. This situation is particularly critical for modification to aging systems that are operating at or near full capacity.

- A project is ongoing to provide two chilled-water cooling loops for this complex to share space cooling capability among the buildings and to separate building space-cooling flows from laboratory electronics and process cooling flows, but this change will do little to address air quality concerns.

- To relieve this problem, SNL/NM is planning to conduct a gradual relocation of a portion of its ongoing hazardous chemical research work from this laboratory complex to facilities that are sited in less densely populated areas. This move will effectively reduce the ventilation and cooling requirements by decreasing the number of local exhaust systems operating in these buildings.

ATTACHMENT 3

SELECTED ACRONYMS

AL	DOE Albuquerque Operations Office
AMPL	Advanced Manufacturing Process Laboratory
BMHA	Building Modification Hazard Assessment
CIS	Chemical Information System
CRADA	Cooperative Research and Development Agreement
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
ES&H	Environment, Safety, and Health
HWMF	Hazardous Waste Management Facility
KAFB	Kirtland Air Force Base
KAO	DOE Kirtland Area Office
MDL	Microelectronics Development Laboratory
MSDS	Material Safety Data Sheet
NEPA	National Environmental Policy Act
OSHA	Occupational Safety and Health Administration/Act
PHA	Preliminary Hazard Assessment
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
SNL/NM	Sandia National Laboratories/New Mexico
SOP	Standard Operating Procedure