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Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract W-7405-ENG-48.
Hazards Control Department

1996 Annual Report

June 30, 1997

Approved by:

George W. Campbell, Department Head
Hazards Control Department
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<td>ANSI</td>
<td>American National Standards Institute</td>
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<td>AVLIS</td>
<td>Atomic Vapor Laser Isotope Separation</td>
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<td>ALARA</td>
<td>As Low As Reasonably Achievable</td>
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Preface

This annual report on the activities of the Hazards Control Department (HCD) in 1996 is part of the department's continuing effort to foster a working environment at Lawrence Livermore National Laboratory where every person has the means, ability, and desire to work safely. The significant accomplishments and activities, the various services provided, and research into Environment, Safety, and Health (ES&H) issues by HCD would not have been possible without the many and ongoing contributions by its employees and support personnel. The HCD Leadership Team thanks each and every one in the department for their efforts and work in 1996 and for their personal commitment to keeping one of the premier research and scientific institutions in the world today a safe and healthy place.

If readers have any questions concerning any of the information in this report, contact the appropriate member of the HCD Leadership Team:

Department Head
Deputy Department Head
Assistant Department Head for Administration
Criticality Safety Group Leader
Education, Training, and Safety Analysis Group Leader
Emergency Management Division Leader
ES&H Team 1 Division Leader
ES&H Team 2 Division Leader
ES&H Team 3 Division Leader
ES&H Team 4 Division Leader
Integrated Safety Management/Work Smart Standards Office
Safety Labs Division Leader
Special Projects Division Leader
Technical Support and Policy Development Division Leader

George Campbell
Jim Jackson
Joel Wong
Song Huang
Scott Hildum
John Sharry
Ross Wilson
Mike Trent
Al Celoni
Steve Carr
Dave Short
Becky Failor
Yee Ping Chong
Dave Myers

Additional contributors: Jerry Bardecker, Pat Boyd, Corky Burgin, Steve Homann, Nancy Kuret, Pete LaCurtis, Sharon Miraglia, Jan Nivens, John Pearson, Chuck Prevo, Kathy Shingleton, John Scott, and Jack Sims.

General Editor: John Richards
The Lawrence Livermore National Laboratory (LLNL), which was founded in 1952 on the site of a closed U.S. Naval Air Station as the “University of California Radiation Laboratory at Livermore,” has gone through many changes since the early days of the Cold War. In the beginning, the Laboratory’s single focus was that of thermonuclear weapon development. Over the last 45 years, it has grown and changed into one of the premier scientific and engineering research facilities in the world. Under the direction of the University of California, the Laboratory has created a collegiate atmosphere on its two federal properties—the main Laboratory site, which is a densely populated mile-and-a-half-square area in Livermore, and the eleven-square-mile Explosive Test Site near Tracy, California, which is known as Site 300. At these two sites some 7,300 UC scientists, engineers, and support staff and 1,500 contract employees focus their efforts on research in the national interest. This research includes topics associated with national security, energy, the environment, biomedicine, economic competitiveness, and science and mathematics education in addition to the Laboratory’s historical role in nuclear weapons stockpile management and international treaty verification activities. And while the mission of the Laboratory has grown and changed, one thing that has not is its commitment to the health and safety of its work force and that of the community in which it is located.

The Hazards Control Department has been a primary contributor to the Laboratory’s successful efforts in the area of protecting the safety and health of those at the Laboratory. HCD employs nearly 300 professional specialists and technical personnel with expertise in industrial safety, industrial hygiene, explosives safety, nuclear criticality safety, fire fighting, fire protection, health physics, safety analysis, safety and health education, training, and research. The department is one of three Environment, Safety, and Health departments reporting to the manager of Plant Operations at LLNL. The other two are Health Services (HSD) and the Environmental Protection Department (EPD). In collaboration with these two organizations, HCD functions as a leader in integrating the minimization of risk and the control of workplace hazards into the thoughts, plans, and actions of Laboratory management and staff.

**Purpose and Vision**

The primary purpose of HCD is to foster a working environment at LLNL where its staff, subcontractors, and visiting researchers have the means, ability, and the desire to work safely. Given the diverse nature of the work at LLNL, this is by no means a simple task. The department vision is that

“The individuals in the department will enhance the mission of LLNL and its programs by being an integral part of each program and participating in the planning and execution of existing and new experiments, and in the design, construction, and maintenance of equipment and facilities. The professional expertise of our Department and the personal integrity of its individual members will be held in the highest esteem by our Laboratory colleagues, the University of California, agencies of government, and the general public. We will be a center of excellence and advancement in the field of occupational health and safety.”

In support of the Hazards Control vision statement, the programs and staff of the department have become nationally recognized for their participation and involvement in setting both national and international health and safety standards and policies. HCD staff members not only actively participate in various U.S. Department of Energy (DOE) ES&H Programs, but also work with other regulatory agencies and related advisory committees to help draft new and revised health and safety standards. In many cases, the research programs of our Special Projects Division (SPD) provide the scientific and technical basis for development of new health and safety standards used throughout the nation and, in some cases, the world.
An Accident Prevention Philosophy for LLNL

In 1996, HCD continued its commitment to the concept known in the department as the Accident Prevention Program (APP). The philosophy of this program is simple and straightforward. The APP is defined as "a continuously improving atmosphere, in which

- LLNL is strongly committed to excellence in ES&H throughout our operations. We emphasize that safety planning must be an integral part of program planning and shall not be compromised
- The safety of people and the environment are held in the highest regard
- Property is protected
- Potential causes of accidents are controlled
- Both the Laboratory and the individual are held accountable for unsafe behavior."

As part of the program, HCD employees have identified the essential elements needed for the philosophy articulated in the APP to succeed at Lawrence Livermore as

- Management leadership
- Establishment of ES&H controls
- ES&H education through training
- Efficient and effective use of resources
- Employee commitment
- Integration of ES&H principles into Laboratory Research & Development (R&D) and operations

- Clear assignment and acceptance of responsibility and accountability
- Use of a behavior-based approach to ES&H management.

In addition, the department and the staff had to make a personal commitment to these elements by supporting efforts at

- Auditing, oversight, monitoring, and corrective actions
- Root cause identification, risk assessment, and control
- Management commitment and involvement
- Solutions through innovation and creativity
- Simplification of ES&H elements
- Focusing support on real ES&H issues rather than compliance
- Two-way communication, trust, and perseverance
- Record-keeping
- Recognition of quality work by employees and excellence in ES&H

- Measurement and feedback to LLNL on its efforts to
  - Reduce accidents
  - Reduce environmental incidents
  - Reduce occurrence reports
  - Reduce worker compensation cases and costs.

This report summarizes the department’s efforts on the Accident Prevention Program for Lawrence Livermore in calendar year 1996.
II. Organization

Some small organizational changes were made in 1996. The Hazards Control Department now consists of eleven divisions and one project office, as depicted in Fig. 1.

Specific descriptions of the staffing and functions of each element of the Hazards Control Department can be found in Appendix A of this report.

Figure 1. Hazards Control Department organization chart.
This section contains a summary of the major accomplishments of the Hazards Control Department for the 1996 calendar year. Emphasis is placed upon the nonroutine programmatic, institutional, and external achievements in order to highlight the department’s commitment to the APP, rather than the regularly performed, routine tasks and activities.

**Audits, Oversight, and Monitoring of Corrective Actions**

**DOE/OAK Annual Appraisal**

HCD staff from Technical Support and Policy Development (TSPD) and ES&H Teams 1, 2, 3, and 4 participated both in the preparation for and the actual DOE/OAK appraisal in November of the Laboratory’s Self-Assessment Program and the Instrument Calibration Program. Specific topics covered included elements of the LLNL ES&H program that are provided by HCD, such as health physics, chemical hygiene, seismic safety, occurrence reporting, fire protection, and the calibration of ES&H instruments. HCD also assisted the various directorate staffs during their individual audits by providing subject matter experts to assist in explaining to the auditors how HCD helps a directorate implement the LLNL ES&H programs.

The audit team for LLNL’s equipment calibration program noted in their draft written report that the “Calibration and historical records database and the recall system in use for radiation monitoring instruments at Hazards Control were thorough, appropriate, and timely.”

**Radiological Training Assessment**

During 1996, Hazards Control provided major support to LLNL’s effort to assess the extent of compliance with the mandatory training requirements of 10 CFR 835, the federal law governing radiological safety in DOE operations. TSPD personnel developed a spreadsheet for LLNL Programs that is used to identify the appropriate training requirements and to determine who has completed the training requirements within the last two years. In mid-June, approximately 49% of LLNL employees and contractors had completed all their training requirements. By mid-August, approximately 98% of LLNL employees had completed their training requirements. The remaining 2% were informed by their management that they could not conduct radiological operations until their training was completed. Through the remainder of 1996, TSPD continued to keep program management informed of the training status of the identified radiological workers.

**10 CFR 835 Internal Audits**

TSPD developed a protocol for performing the triennial internal audits required by 10 CFR 835 of all functional elements of the Radiation Protection Program. The protocol was developed with input from the ES&H Teams and was approved by LLNL’s ES&H Working Group. The audit protocol involves a health physicist from TSPD who coordinates and conducts the audits on a facility-by-facility basis and formally submits a report to the facility management. The report identifies noteworthy practices, concerns, and deficiencies. DOE identified the audits as a Noteworthy Practice in their annual ES&H Oversight Appraisal of LLNL.

**DOE Explosive Safety Review**

ES&H Team 1 Explosive Safety Engineers provided support to a DOE/OAK Explosives Safety Surveillance that was conducted at Building 191, the High Explosives Application Facility (HEAF) and at the Site 300 explosives facilities. DOE/OAK also looked at their oversight of LLNL as part of this review. The DOE reviewers concluded that LLNL has established and implemented a good safety program consistent with DOE’s explosives safety expectations.

**Electrical Safety Audits**

Members of TSPD coordinated the Hazards Control response to the appraisal of the LLNL electrical safety program that was initiated by the LLNL Assurance Review Office. The audit covered all aspects of electrical safety including training, management involvement, consistency, procedures, and the number and reporting of shock incidents. The proposed response to the findings was prepared by the Electrical Safety Advisory Board, which is chaired by the TSPD Division Leader.

ES&H Team 3 and TSPD performed a special electrical safety inspection of the LINAC/Positron Facility located in Building 194. The assessment showed serious electrical concerns. As a result of the assessment, specialized training, upgraded access requirements, facility modifications, and increased attention by facility personnel and management are being implemented in the facility.
Root-Cause Identification, Risk Assessment, and Control

Criticality Assessments

The Criticality Safety Group (CSG) completed a comprehensive criticality safety assessment program to assist the Plutonium Facility in reaching its milestone of implementing DOE Order 5480.24. In addition to this assessment, CSG supported the first annual review of the criticality safety program conducted by the Director’s Office. The review focused on the management, staffing, and funding of the new Criticality Safety Group and the computer-based inventory systems in Building 332. In general, the audit findings stated that the plan to reestablish an appropriately staffed Criticality Safety Group was progressing in the right direction.

Deficiency Tracking (DefTrack) Prioritization

ES&H Team 3 worked with the Engineering Assurances Office to assess and prioritize the FY96 DefTrack Findings, utilizing a Risk Assessment Code/Abatement Priority Number ranking system developed by a Team 3 Industrial Safety Engineer.

Camp Parks Closeout

ES&H Team 4 completed clearance surveys of warehouses used by the Laboratory over the past decades that are located at the U.S. Army Camp Parks Reserve Training Facility in Dublin, California. The Laboratory will no longer use Camp Parks for storage; these surveys were performed as a prudent precaution to ensure that no contaminated debris was in the area. The survey effort consisted of gross alpha/beta, tritium, and beryllium swipes of the floor, walls, and portions of the ventilation system. Floor swipes were performed prior to the floor sweep. Random surveys were also performed. No contamination was discovered as a result of any of the surveys.

Lessons Learned

TSPD developed and distributed 34 Lessons Learned (LL) documents via e-mail during CY96. Of these, 31 were standard LLs, which are distributed to approximately 550 managers and supervisors. They cover a wide range of topics ranging from incompatible chemicals to personal use syringes. This is about a 50% increase over the 22 LLs distributed in 1995. The three other Lessons Learned were Glovebox Lessons. These were requested by the programs to address the special interests of those who work with glovebox enclosures, and were distributed to a more limited population of approximately 80 people. The Lessons Learned are available on the Laboratory’s internal home page at


National Ignition Facility

ES&H Team 2 staff coordinated the writing and editing and provided major input and analysis for the Preliminary Safety Analysis Report (PSAR) for the National Ignition Facility (NIF). The football stadium-sized facility will house a massive laser composed of 196 individual beams focused on a marble-sized target in the center of a 40-ft-diam spherical chamber. The goal is to implode the target, which contains a mixture of deuterium and tritium, creating temperatures and pressures high enough to ignite a fusion reaction and release more energy than the lasers deliver to the target. The 300-page PSAR was a key document in the overall process of getting NIF approval by the DOE. This safety analysis showed that the facility posed little to no risk to the surrounding community.

Many ES&H Team 2 disciplines were also key reviewers during the week-long Advance Conceptual Design Review for NIF and worked closely with project engineers and designers on the Title I and Title II Designs. Of special note are the contributions of Mike Singh, Health Physicist, ES&H Team 2. Mike provided significant technical and scientific direction to the architectural and engineering firm on the design of the extensive ionizing radiation shielding for the Laser/Target Area Building, and he designed the radiation safety program for the facility. Mike was nominated and received the 1996 LLNL Director’s Achievement Award for this work.

The Deputy Division Leader for ES&H Team 2 and the Construction Safety Engineer from ES&H Team 4 worked closely with the NIF Assurance Office to develop the Construction Safety Program for the National Ignition Facility (UCRL-ID-125990). This document, scheduled to be published in early 1997, sets forth the responsibilities, guidelines, rules, policies, and regulations for all contractors and workers involved in the construction of the main NIF buildings, installation of special equipment (e.g., lasers, capacitors), and activation of NIF at LLNL.
ES&H Team staff review plans for new buildings at LLNL for life safety concerns. The National Ignition Facility (right) was among those reviewed in 1996.

**Contained Firing Facility**

ES&H Team 1 members were very active participants in several design reviews of the Contained Firing Facility (CFF) and provided explosives safety support for the proposed upgrade to Bunker 801. Design reviews of 35% and 65% were completed. Although the use of tritium in the facility has been placed on hold for the immediate future, significant health physics-related work has gone into CFF design criteria and possible flash x-ray operation during construction.

**Site 300 Siting Analysis Documents**

An explosives safety engineer on ES&H Team 1 completed nearly all the quantity-distance separation analysis and supporting documentation for the Chemistry and Process Area facilities at Site 300. This major project took nearly 18 months, producing a set of highly detailed siting documents for nearly every explosives-related facility at Site 300 (31 explosives operating buildings and 50 explosives storage magazines). In addition to the quantity-distance analysis, each siting document also includes an analysis of power line issues, a lightning risk assessment, and a list of all equipment used in the facility. This documentation is an integral part of each facility’s Safety Analysis Report (SAR) and will provide the basis for any future facility construction, modification, or programmatic use.

**Site 300 Safety Analysis and Process Safety Management Documents**

ES&H Team 1 and the Education, Training, and Safety Analysis Group (ET&SAG) completed Safety Analysis documents for the Firing Area as well as for the Materials Management and Weapons Program activities at Site 300. Basis for Interim Operations (BIOs) documents were also prepared for the Process Area and Chemistry Area operations. In support of the BIOs, a safety analyst from ET&SAG and an explosives safety engineer from Team 1 provided major support for a Process Safety Management (PSM) analysis, as required by the Occupational Safety and Health Administration (OSHA), CFR Section 1910.119.

The PSM analysis resulted in a risk classification of "moderate" for several Site 300 Process Area explosives operations. Although it is believed that these operations meet the minimum requirements of the DOE Explosives Safety Manual (M-010) for level of protection criteria, there was a concern for lack of guidance in determining the hazard classifications and characterization of risk for explosives facilities. This same issue has been continually brought up by other DOE contractors and discussed at length during DOE Explosives Safety Committee meetings since about 1990 with no resolution. A complete DOE Explosives Safety Manual compliance review will be performed on these operations in 1997, and it will be used as a basis for determining how to best proceed. The DOE-OAK facility representative is aware of this lack of guidance issue, and supports an improved methodology for risk assessment of explosives facilities within DOE.

**Management Commitment and Involvement**

**DOE Quality Award Application**

In 1996, HCD applied for the "DOE Quality Award" created by DOE as a way to recognize its best contractors.
as world-class organizations. HCD's 56-page application was assessed by DOE reviewers against nationally recognized principles used by successful companies around the world. The department invested in the quality award application process as a way to assess its implementation of the Accident Prevention Program and become an even more successful organization for its customers and employees. It required that the department look at itself from a different perspective and identify both strengths and areas for improvement. This was the first in-depth, across-the-board internal review of the whole department since HCD reorganized in 1993.

During the development of the quality award application, the department confronted many basic but difficult questions about its purpose, its customers and employees, its processes and measures for determining success. After their visit to LLNL, the review team reported that the department was off to a strong start, and had processes in place to make improvements. However, not enough time had elapsed from the initial changes since the department reorganization in 1993 to convince them that the results were of a continuously improving nature. So while the department did not receive the award, what was learned during both the writing of the application and the site visit was deemed valuable in establishing a baseline for HCD as well as a knowledge base for developing improvements to its operations.

Missile Test Range On-Site Support

The Deputy Division Leader for ES&H Team 1 continued in 1996 to provide on-site safety support to the Air Force Flight Systems Test Group for Peacekeeper Flight Tests at the Kwajalein Missile Range located in the South Pacific.

UC Corporate Activities

The leadership role by HCD from a UC standpoint is evidenced by its involvement in the following activities:

Interaction between the UC Laboratories. In 1996, the University of California Office of the President placed additional emphasis on investigating areas where the three UC National Laboratories (LLNL, LANL, and LBNL) could cooperate in the area of ES&H. As a result, a Tri-Lab cooperation working group was established. As part of this effort in radiation safety, the whole body counting facilities at the three UC Laboratories are in the process of finalizing an agreement to provide backup services to each other. In addition, the facilities are jointly reviewing the proposed DOE Laboratory Accreditation Program (DOELAP) technical standard and reviewing each other's operations in an effort to identify additional areas for cooperation.

Support to LBNL. HC staff from TSPD and the ES&H Teams supported the Lawrence Berkeley National Laboratory (LBNL) Work Smart Standards (WSS) project. The project required half-time support for approximately three months from half a dozen HCD staffers. This involvement encompassed work on three separate integrated support teams, and will be reciprocated by LBNL for Lawrence Livermore's WSS project.

The Safety Labs Division (SLD) Personnel Dosimetry team provided extensive assistance to LBNL in 1996. This included the development of a computerized dosimetry database, and the team routinely processed finger rings and CR-39 dosimeters for LBNL. This cooperation will continue in 1997, along with the exploration of ways to expand interactions between the Laboratories in the area of personnel dosimetry.

HCD External Activities

As in past years, HCD personnel remained active in many national and international ES&H organizations and committees, whose standards and requirements have a direct impact on operations at LLNL. These included:

- American National Standards Institute (ANSI)—Member: Z88.2 Standard for Respiratory Protection; Z136.1 Standard for Safe Use of Lasers
- American Industrial Hygiene Association (AIHA)—Member: Respiratory Protection Committee, Indoor Environmental Quality Committee, Biological Monitoring Committee, Gas and Vapor Detection Committee, Environmental Lead Laboratory Accreditation Committee, Committee on Redefining the Industrial Hygiene Profession (with American Conference of Governmental Industrial Hygienists and American Board of Industrial Hygiene)
- American Conference of Governmental Industrial Hygienists (ACGIH): Chair of Board of Directors, Chemical Substance Threshold Limit Value (TLV) Committee, Nonionizing Radiation Committee, Lead instructor for developing course on Non-Ionizing Radiation
- DOE Explosives Safety Committee Member
- National Fire Protection Association (NFPA): Advisory Council Member and Principal Member of several NFPA committees, including:
  - NFPA #45, Fire Protection for Laboratories Using Chemicals. This technical committee will be responsible for the development of national standards for the prevention of loss of life and damage to property from fire and explosion in chemical laboratories
  - NFPA #75, Protection of Electronic Computer/Data Processing Equipment
— NFPA #241, Construction, Alteration, and Demolition Operations
— NFPA #750, Water Mist Fire Protection Systems
— NFPA, Technical Correlating Committee for Fire and Emergency Services Protective Clothing and Equipment
— NFPA, Technical Committee for Structural Fire Fighting Protective Clothing and Equipment, a national committee to develop the standards and codes for testing and design of fire fighter equipment
— NFPA, Technical Committee for Respiratory and Personal Alarm Equipment
— NFPA #1500, Technical Committee on Fire Service Occupational Safety and Health—Chair
— NFPA #101, Technical Committee on Assembly and Educational Occupancies—Chair
— NFPA #1250, Technical Committee on Fire Department Risk Management
— NFPA #1141, Technical Committee on Forest and Rural Fire Protection
• Health Physics Society—Chairperson of Venues Committee
• American Board of Health Physics—Panel of Examiners (Part II)
• Department of Energy, Committee to Review the Surface Contamination Limit Values in Appendix D—Member
• International Committee on Beryllium Monitoring—Chairman
• National Council on Radiation Protection, chartered by the U.S. Congress to make recommendations regarding radiation protection standards and practices in the United States—Member
• California Public Utilities Commission Stakeholder’s Consultants Committee—Chair
• Semiconductor Equipment and Materials International Gasses and Facilities Safety Committee—Member
• Institute of Electrical and Electronic Engineers Standards Coordinating Committee 28 (drafts ANSI series of standards on Electrical Safety)—Member
• International Society for Respiratory Protection (ISRP)—President 1995–1997
• American Society for Testing and Materials, F-23 Committee on Protective Clothing—Vice Chairman, 1995–1997
• ANSI, Z88 Secretariat—ongoing Chairman
• National Institute of Occupational Safety and Health (NIOSH), Worker’s Family Protection Task Force—Member, September 1994–June 1998
• ANSI, Writing group for ANSI 8.23 standard on Nuclear Criticality Accident Emergency Planning and Response—Member
• American Industrial Hygiene Association (AIHA)—Board of Directors, 1995–1998
• ANSI, Air Monitoring for Radioactivity—Chairman
• ANSI 13.43 Working Group on Anthropometric Phantoms. This work will help establish appropriate standards for the use of human surrogate structures in the measurement of internally deposited radionuclides—Chairperson
• International Commission on Radiological Units Working Group on “The Determination of Internally Deposited Radionuclides.” This group will define appropriate methods for the measurement of internally deposited radionuclides—Member
• Nuclear Criticality Technology and Safety Project, Session V, “Criticality Safety Related to Weapons Material Disposition”—Co-Chairperson
• ANSI 8.12 Working Group to update ANSI/ANS 8.12 Standard—Member.

Solutions Through Innovation and Creativity

W-79 HE Dissolution Workstation Fire Risk Analysis

The Special Projects Division (SPD) was involved with planning and conducting a fire risk analysis (FRA) for the W-79 HE Dissolution workstation processes at the Pantex plant. This analysis will be used to identify any fire-related hazards that might not be apparent. Analyses of internal and external fires were conducted for this FRA as well as the building fire management response to various fire events. SPD also provided support and input into the development of fault tree analysis for this system and failure probabilities. Analyses show that the likelihood of fire is less than one in a million ($10^{-6}$) and the probability for high-explosive detonation or deflagration would be even less. In addition, some aspects of this operation do not comply with designated standards, and this analysis will be used to obtain any necessary variances or equivalencies necessary to allow operations to proceed.

Fire Protection Engineering Cost Reduction

The TSPD Technical Leader for Fire Protection developed a proposal for reducing the costs of fire protection for LLNL computer and control rooms by raising the value threshold requiring subfloor protection from $1M to $10M. The Laboratory’s ES&H Working Group reviewed and overwhelmingly approved the proposal, which was fully implemented. It is estimated that it will save the Laboratory about $200K per year as it phases out under-the-floor halon systems.
Internal Dosimetry Upgrade

HCD continued to provide analytical and calculational support for a number of potential internal exposures to radioactive materials at the Laboratory. To facilitate calculation of internal doses, TSPD's Internal Dosimetrist completed the first transition phase to the new "physiological" biokinetic models for uranium and transuranic elements for interpretation of bioassay results and calculation of internal doses. These models are the basis for revised dose conversion factors published in International Commission on Radiological Protection (ICRP) Reports 56 through 72. This first phase involved acquisition of mathematics software (MAPLE and MathCad), and development and testing of worksheets that solve the complex systems of linear first-order differential equations that are used to describe the uptake, retention, recycling, and excretion of these elements in the body.

Laboratory Modification Planning

ES&H Team 3 has worked closely with the Chemistry and Materials Science (C&MS) Division to develop a safe, effective means of completing laboratory modifications and laboratory moves. C&MS and Team 3 used dedicated team members, project work plans, and prestart and post job reviews. This process resulted in projects completed in 10 buildings and/or trailers with no lost time due to injuries or reportable incidents. The projects included such work as the removal of hoods, vacuum lines, and duct work in Buildings 224, 225, and 226; removal of an explosives and mercury-contaminated underground vacuum system between Buildings 225 and 226; and removal of mercury and explosives-contaminated vacuum lines in Building 227.

Work with Asbestos

A Team 4 Industrial Hygienist assisted in the development of comprehensive Minuscule Asbestos Procedures (MAP) that utilize the LLNL Negative Exposure Assessment (NEA) system. MAP-NEAs were created to eliminate more than 75% of the problem situations at the Laboratory associated with asbestos. Using the Industrial Hygiene NEA policy as a guideline, techniques were developed with Plant Engineering personnel that reflect their actual field practices. MAP-NEAs have proven to be cost-effective and have done much to streamline the efforts of both the Industrial Hygienists and the Plant Engineering crafts. Twenty-four MAP-NEA techniques were developed and approved by TSPD.

Emergency Response Equipment for the Russian Ministry of Defense

SPD led a project to procure, calibrate, and provide procedures and training for emergency response equipment to be used by the Russian Ministry of Defense in the event of a nuclear weapons accident. This project was completed on time and within budget. The Russian Ministry of Defense has requested additional equipment.

Rapid Radiological Emergency Response Vehicles for the Nation of Belarus

After successful completion of the Belarus "Hot Spot" Trailer project, SPD led another project to provide two rapid response vehicles to be used in rough terrain after an accident with radioactive materials. Both units were constructed and delivered on time and within budget.
HCD Facilities

The SLD Bioassay Laboratory operations returned to renovated Building 254 in March 1996. Operations were back on-line in April. The building renovation provided 1,500 square feet of additional space, HVAC upgrades, and a central exhaust system. The added laboratory space allows the separation of routine, low-level samples from samples with a known or suspected higher activity level, thus reducing the potential of cross-contamination.

A new Hazards Control Training Center was established in Trailers 2679 and 2627. The new Training Center consolidated and expanded functions that had been performed in several smaller and scattered facilities, and provided additional space for classrooms, computer-based training, and new “practical” laboratory training.

SPD's Filter Test and Development facility was relocated from a collection of very old trailers in the 5900 block to laboratories in Building 255. This was possible because of funds made available from the Institution to expedite the closure and removal of aged facilities. The old trailers, T5902, T5904, and T5905, were returned to the Institution for future demolition.

A Congressional line item proposal for a new Site 300 Fire and Medical Facility (approximately $5 million) was approved by the Laboratory and DOE and is included in the President's budget plan for FY98.

The HC Property Center is committed to maintaining a department property management system that results in the efficient management of property throughout the divisions and ES&H Teams. The property center inventoried and reconciled attractive and home-use assignments for the 1996 annual inventory. The department accounted for 100% of the property assigned to its six property centers.

Simplification of ES&H Elements

Electrical Safety and Lock and Tag Procedures

TSPD played a key role in producing updated electrical safety documents, Health & Safety Manual Chapter 23, “Electrical Safety,” and Supplement 23.01, “Safe Work Practices for Electrical and Electronic Equipment and Utility and Facility Power Systems,” were guided through to final approval. There were contentious issues in both documents and TSPD spent considerable time negotiating with all interested parties in achieving consensus.

TSPD also gained agreement from technical and management organizations in developing a new, Laboratory-wide Lockout and Tag Program and incorporating it in Health & Safety Manual Supplement 26.13. TSPD received special acknowledgment by LLNL's ES&H Working Group for accomplishing this task.

Lockout and Tag Implementation Program

ES&H Team 3 worked with the Engineering Directorate Assurances Office to develop a Lockout and Tag Program for electrical and hazardous stored energy systems. This plan, which implements the LLNL Lockout and Tag requirements, is being used by other directorates at LLNL as the basis for developing their own Lock and Tag implementation plans.

10 CFR 835 Implementation

TSPD obtained several exemptions for LLNL to 10 CFR 835, Occupational Radiation Protection, which allowed for cost-effective implementation of the occupational radiation safety requirements without compromising safety or unnecessarily impacting LLNL's programmatic mission. Hazards Control is continuing to work with DOE and DOE contractors to promulgate risk-based, cost-effective regulations. For example, health physicists from TSPD and Los Alamos National Laboratory (LANL) developed and provided to DOE a risk-based, sealed radioactive source accountability program. If DOE adopts this program, it would save on the order of $300,000 per year at LLNL alone, while still providing safety through an appropriate level of control. TSPD also continues to spearhead the effort to work with the Los Alamos and Lawrence Berkeley National Laboratories and DOE contractors to generate consensus recommendations on the proposed revision to 10 CFR 835.

X-Ray Safety Program

Working with the ES&H Teams, TSPD's X-Ray Safety Officer streamlined the Radiation Generating Device (RGD) Safety Program by integrating the assessment and controls for “incidental” radiation producing devices, x-ray machines, and accelerators. The streamlined program utilizes a new approach to classifying RGDs, which is based on the hazard potential of the device rather than on the energy of the machine or whether the radiation is produced intentionally or as a by-product of use. The program is in the review process, and when fully implemented should significantly enhance worker safety and LLNL's ability to demonstrate compliance. This program is being documented in Supplement 33.47 of the Health & Safety Manual.
World Wide Web-Based Training

Working together, TSPD and ET&SAG placed four basic Pressure Safety courses and one re-qualification course on the Laboratory’s World Wide Web page. This will allow all employees to complete basic awareness and operator training courses at their own workstation.

An updated Electrical Hazards Awareness course and a Lockout and Tag Program Refresher course were also placed on LLNL’s Web Page. This allows employees to increase their hazard awareness and obtain the latest information on LLNL Electrical Safety Programs.

Development of a Real-Time Beryllium Monitor

In 1996, SPD continued to work on a project to develop a commercially available, real-time beryllium monitor using outsourcing to facilitate the calibration of the monitor and test its performance in workplace environments. ADA Technologies, Inc., was awarded the contract to design and fabricate the monitor. Conceptual design was completed in 1996. Another firm will be selected to calibrate the monitor, and LANL has agreed to provide technical support and testing in a workplace environment.

Focusing Support on Real ES&H Issues Rather Than Compliance

Toxic Gas Usage Review

ES&H Team 3 coordinated a complete review of toxic and pyrophoric gas use practices in Building 197. This was done in conjunction with the writing of the Preliminary Hazard Analysis (PHA) and the Facility Safety Plan (FSP) for the building. The Physics & Space Technology (P&ST) Directorate made a number of engineering changes, including modifying the restricting orifices on some bottles and upgrading the ventilation ducting on the roof. Based on the review, P&ST also purchased a new toxic gas monitoring and control system to replace the current system in the building.

Biology & Biotechnology Research Program—NMR Facility

ES&H Team 2 was significantly involved in the design, construction, and activation of a new 600-Hz Nuclear Magnetic Resonator (NMR) facility. The instrument, which is used to support the structural biology program at LLNL, was located in renovated Building 364. Team 2 personnel were brought into the project at an early stage by the Plant Engineering (PE) Project Manager, which allowed the fast-track project to be carried out with all ES&H issues (e.g., magnetic fields, potential for oxygen deficiencies) addressed up front, thereby preventing any delay in activation of the facility.

Custodian Ergonomics Program

ES&H Team 4 completed the video taping of custodians for the purpose of analyzing how they perform routine work-related tasks. The video tapes were used to observe worker motions and body positions while performing routine custodial activities. Some remarkable ergonomic information was obtained through this effort. Specifically, repetitive motion stressors could be readily identified through careful viewing of the video. The stressors can now be mitigated through a custodial ergonomics training program. A report was compiled to make this information available to interested personnel.

In addition, a Team 4 Industrial Hygienist and Industrial Safety Engineer, in cooperation with the PE Custodian Quality Improvement Team, initiated work on the development of a custodial ergonomics training video entitled “The Adventures of Ergoman.” This video is intended to furnish custodial workers with easy and understandable techniques whereby ergonomic stressors can be identified and mitigated by the custodians themselves. Key components of the video include:

- Identification of high-risk work practices (e.g., awkward body positions, adapting to tools, high-risk postures)
- Posture analysis (e.g., neutral positions, radial/ulnar deviations, tool use)
- Posture targeting (e.g., making ergonomics accessible to custodial work groups, training modification through restored posture, ambidexterity, and increased risk awareness).

Scripting, production, and preliminary filming of the video are complete. The video is scheduled for release in early 1997.

Security Console Ergonomics

An ES&H Team 4 Industrial Safety Engineer traveled to the Pantex Plant in Texas to evaluate their Central Alarm System (CAS) work consoles for ergonomic considerations. The Safeguards & Security Department (S&SD) had purchased similar units and wanted them to be ergonomically correct for the operators. In general, the Pantex CAS units had some intrinsic ergonomic stressors. A report outlining the findings and recommendations was forwarded to S&SD.

Hazards Control Department
Training for Labor-Only Contractors

TSPD agreed to provide certain Laboratory-specific training to "Labor Only" contract employees. The TSPD's interpretation of the current "Labor Only" contract is that general training of the contract employees (including health and safety training) is the responsibility of the "Labor Only" contractor. However, there is a provision in the contract whereby the Laboratory will provide "specialized training or orientation" as required by the Laboratory. Laboratory-specific training available for these contract employees has been identified (e.g., Confined Space Entry, Lock & Tag Procedure, Respirator Training) in a memo to the University's representative for the "Labor Only" contract.

Training

ET&SAG was heavily involved in the design of the new LTRAIN course-completion tracking software because health and safety courses comprise 60% of the courses and 80% of the course completions at the Laboratory. Once fully implemented, the new tracking system will significantly improve how training course records are managed at LLNL. In addition, ET&SAG agreed to take over responsibility for Emergency Management class scheduling and maintenance of Emergency Preparedness training records, which in 1996 had been transferred to the Emergency Management Division (EMD).

ORC Respiratory Protection Project

SPD continues to focus on respiratory protection, a long-standing core competency. A contract with Organization Resource Counselors (ORC) has been finalized that will fund the simulated workplace testing of supplied-air and powered-air purifying respirators, utilizing SPD's state-of-the-art man test facility. SPD staff have worked closely with ORC, ORC pharmaceutical company members, OSHA, NIOSH, and respirator manufacturers to develop a test protocol acceptable to everyone. When the performance evaluations are complete, a report will be prepared and the actual test data will be shared with OSHA in support of current regulatory activities for revision of their respirator standards (29 CFR 1910.134). This study represents a major accomplishment in demonstrating how respirator manufacturers and users can effectively interact with government agencies such as OSHA and NIOSH with the help of interested third parties such as ORC and LLNL. Additional respirator testing is planned as part of this contract with ORC.

Further Development of the Cleanable Steel HEPA Filter—Cost/Benefit Analysis and Comparison with Competing Technologies

SPD has made further progress in developing a cleanable, steel-fiber high-efficiency particulate air (HEPA) filter. SPD fabricated a pleated cylindrical cartridge using commercially available steel fiber media that is made with 1-μm-diam stainless-steel fibers and sintered into a sheet form. Test results at the Filter Test Station at Oak Ridge National Laboratory show the prototype filter cartridge has 99.99% efficiency for 0.3-μm dioctyl phthalate (DOP) aerosols and a pressure drop of 1.5 inches. Filter loading and cleaning tests using AC Fine dust showed the filter could be repeatedly cleaned using reverse air pulses. Analysis of commercially optimized filters suggest that cleanable steel HEPA filters need to be made from steel fibers less than 1 μm in diameter, and preferably <0.5 μm, to meet the standard HEPA filter requirements in production units.

SPD has demonstrated that 0.5-μm steel fibers can be produced using the fiber bundling and drawing process. The 0.5-μm steel fibers are then sintered into small filter samples and tested for efficiency and pressure drop. Further work is required to complete the development of steel HEPA filters by SPD.

SPD Activities on Science-Based Stockpile Stewardship Program

The Science-Based Stockpile Stewardship Program requires that LLNL and LANL conduct subcritical experiments (SCE) to develop information for computational modeling of nuclear explosive component performance. These experiments, which involve special nuclear material in combination with high explosives, will be conducted at the underground U1a Complex at the Nevada Test Site (NTS). SPD provided technical and management support to other LLNL Directorates in the development of the hazards assessment document, other requirements documents, procedures, and plans for the conduct of these experiments at NTS. In addition, SPD reviewed draft management directives developed by the DOE Nevada Operations Office for the operations approval and safety review of SCE. This SPD project is an excellent example of the close interaction, cooperation, and application of SPD and other HCD personnel.

Evaluation of Development near Site 300

ES&H Team 1 was involved in the evaluation efforts on the impact of the proposed Tracy Hills
development, located just east of Site 300 near Highway 580. This new development has raised concerns over the prospects of possible civilian intrusions at the Site 300 borders, increased traffic on Corral Hollow Road, and other safety-related issues. One effort supported by Team 1 was a noise measurements test conducted jointly with Site 300 neighbors, SRI, and Physics International. This activity involved the detonation of a number of shots to measure the noise at various locations in and around the proposed development.

Two-Way Communication, Trust, and Perseverance—within the Department and with Clients and Others

Respirator Workshop

TSPD and SLD coordinated and hosted the first DOE Respirator Program Administrator’s Conference and Workshop. Twenty-one people from 18 different DOE facilities attended. This event was extremely well received by all participants: it facilitated sharing ideas and programs for more cost-effective, compliant, and productive programs. Discussion sessions were held on new products, fit testing issues, equipment problems, outsourcing, deconning issues, ANSI and OSHA compliance, and the implications of 42 CFR 84.

Considerable interest in holding future Respirator Program Conferences was expressed by the attendees.

Employee Empowerment

The Safety Labs Division established a method of determining division policy and issue resolution through meetings attended by a representative from each of the division's self-directed work teams. Through these meetings, SLD set policy on allocation and approval of travel and training in SLD and wrote job descriptions for Division Leader, Assistant Division Leader, and Procurement Coordinator. This approach to self-management will continue to be used by SLD to work on and resolve additional issues in the future.

Record Keeping

Injury and Illness Records

In 1996, DOE’s Office of the Inspector General conducted an audit of the OSHA record keeping process at Lawrence Livermore. Subsequent to this audit, TSPD worked with Health Services, Risk Management, and Laboratory Legal Counsel to implement measures to further improve the accuracy of injury/illness data maintained by the Hazards Control Department. TSPD gained on-line access to

An LLNL employee undergoes respirator fitting in the SLD respirator shop (left). An SLD technologist certifies a newly repaired respirator (right).
selected information on the Health Services database and established a practice of bimonthly review of workers' compensation data maintained by Applied Risk Management, the University's Worker Compensation Administrator. The revisions to the process resulted in improved record keeping capability for Hazards Control.

**Material Safety Data Sheets**

A Web-based database of over 25,000 material safety data sheets (MSDS) was installed on a Hazards Control computer and made available to all on-site users. These MSDS are complete, of extremely high quality, and are readily available 24 hours per day, 7 days a week. Workers can search and access MSDS on-line using various computer platforms, and print them locally.

**Fire Loss Statistics**

The Laboratory suffered a single reportable fire loss in 1996. A fire in a chemical storage cabinet on January 19, 1996, resulted in a $2500 loss.

One EMD emergency response goal is a 5-minute total response time to emergency incidents at the Sandia National Laboratories, Livermore, (SNL-CA) and LLNL sites for 95% of the incidents. The EMD response record for 1996, compared to the goal of 95% and the average response time for 1994 through 1995, is shown in Figure 2.

![Fire department emergency response time graph](image)

**Recognition of Quality Work by Employees and Excellence in ES&H**

**DOE Laboratory Accreditation Program Personnel Dosimetry Audit**

The SLD Personnel Dosimetry Team received DOELAP accreditation following an audit in January. The team received an "exceptional" rating from the audit. The audit report stated "the Dosimetry Team is staffed with qualified and dedicated personnel. It was evident that the personnel within the self-directed work team took ownership of the program and exhibited excellent teamwork."
AIHA Accreditation for Environmental Lead Analyses

The SLD Analytical Lab Team applied for and received accreditation from the AIHA for the analysis of lead in paint, soil, and other samples. The accreditation process included three rounds of proficiency testing, submittal of a lengthy application, and a site audit. The AIHA accrediting body said that LLNL’s accreditation request was processed in a shorter time than any other, in part due to the thoroughness with which the application was prepared.

Ergonomics

An ES&H Team 4 Industrial Hygienist and Industrial Safety Engineer supporting Plant Engineering attended the EFCOG “Safety Culture Revolution Through Employee Empowerment Workshop” in Cincinnati. They gave a presentation on the Custodian Ergonomics program at the Laboratory. This presentation was well received for both its technical content and innovative approach. Their talk was titled the “Role of Health and Safety Professionals Within a Safety Culture; a Success Story.”

Necessary and Sufficient Pilot Program

Steve Carr (Division Leader, ES&H Team 4), Sarah Lane (ET&SAG), Ed Ochi (Team 4, Industrial Hygiene), Bev DeOcampo (Team 4, Health Physics), and Steve McConnell (Team 4, Industrial Safety) were all honored for their significant contributions to the Necessary and Sufficient Pilot Program, now known as “Work Smart Standards.” In December, 1996, Vice President Albert Gore recognized the LLNL Pilot program by bestowing the Hammer award to the effort. The Hammer award is given each year to recognize significant governmental programs that save the American taxpayers money.

Off-Site Emergency Support

HCD continued in 1996 to provide emergency response technical and field support to the DOE Accident Response Group (ARG) and the Nuclear Emergency Search Team (NEST). Members of various divisions in HCD have been integral to organizational advancements made over the last year, and continue to provide a critical element of LLNL’s technical support to emergency exercises or incidents, off-normal conditions or situations, and major events such as the 1996 Olympic Games.

HCD personnel also participated in the week-long ARG exercise DIAL FLINTY in Minot, North Dakota. This was the first time some HCD divisions, such as Team 3, have had the opportunity to work with the LLNL Defense Technologies Engineering Division staff in an emergency exercise. Health Physicists from HCD had much to contribute. In fact, the Controllers from both the Hazards Assessment side and the Weapons Recovery side commented on how well they all worked together and how quickly they were able to answer many of the initial questions (that usually take days to investigate) so that the hazards could be evaluated.

In 1996, the Hot Spot emergency response monitoring assets were improved by HCD with a new Tennelec automated gross alpha/beta counter, three EG&G Nomad multichannel analyzers for gamma spectroscopy, and SPARK2 and FIDLER kits based on Eberline’s new E-600.
IV. LLNL Occupational Injury and Illness Statistics

Table 1. Lost and restricted workday comparisons.

<table>
<thead>
<tr>
<th>Total cases</th>
<th>Recordable cases</th>
<th>LD/RD cases</th>
<th>LDs</th>
<th>RDs</th>
<th>Rec. case frequency</th>
<th>LD/RD case frequency</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>LLNL 1994</td>
<td>1,033</td>
<td>437</td>
<td>201</td>
<td>1,773</td>
<td>1,724</td>
<td>5.5</td>
<td>2.5</td>
</tr>
<tr>
<td>LLNL 1995</td>
<td>990</td>
<td>388</td>
<td>150</td>
<td>1,508</td>
<td>1,395</td>
<td>4.9</td>
<td>1.9</td>
</tr>
<tr>
<td>LLNL 1996</td>
<td>947</td>
<td>509</td>
<td>204</td>
<td>2,261</td>
<td>2,268</td>
<td>6.9</td>
<td>2.7</td>
</tr>
<tr>
<td>DOE R&amp;D Contractors 1991-95</td>
<td>3.7</td>
<td>1.7</td>
<td>47.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S. Private Industry 1995</td>
<td>8.1</td>
<td>3.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LLNL by Directorate, 1996</th>
<th>Total cases</th>
<th>Recordable cases</th>
<th>LD/RD cases</th>
<th>LDs</th>
<th>RDs</th>
<th>Rec. case frequency</th>
<th>LD/RD case frequency</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>B&amp;BR</td>
<td>12</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td>10</td>
<td>5.27</td>
<td>1.76</td>
<td>14.05</td>
</tr>
<tr>
<td>C&amp;MS</td>
<td>31</td>
<td>18</td>
<td>3</td>
<td>34</td>
<td>69</td>
<td>5.48</td>
<td>0.91</td>
<td>31.36</td>
</tr>
<tr>
<td>Computation</td>
<td>58</td>
<td>28</td>
<td>9</td>
<td>11</td>
<td>52</td>
<td>4.89</td>
<td>1.57</td>
<td>10.99</td>
</tr>
<tr>
<td>D&amp;NT</td>
<td>16</td>
<td>11</td>
<td>2</td>
<td>4</td>
<td>43</td>
<td>4.98</td>
<td>0.91</td>
<td>21.29</td>
</tr>
<tr>
<td>Dep. Director's Office</td>
<td>118</td>
<td>64</td>
<td>26</td>
<td>335</td>
<td>518</td>
<td>7.63</td>
<td>3.1</td>
<td>101.63</td>
</tr>
<tr>
<td>Energy</td>
<td>13</td>
<td>4</td>
<td>1</td>
<td>23</td>
<td>0</td>
<td>2.91</td>
<td>0.73</td>
<td>16.76</td>
</tr>
<tr>
<td>Engineering</td>
<td>217</td>
<td>122</td>
<td>61</td>
<td>551</td>
<td>809</td>
<td>6.46</td>
<td>3.23</td>
<td>72.04</td>
</tr>
<tr>
<td>Environmental Programs</td>
<td>20</td>
<td>6</td>
<td>1</td>
<td>4</td>
<td>14</td>
<td>2.41</td>
<td>0.4</td>
<td>7.23</td>
</tr>
<tr>
<td>Lasers</td>
<td>25</td>
<td>13</td>
<td>2</td>
<td>21</td>
<td>52</td>
<td>3.28</td>
<td>0.5</td>
<td>18.42</td>
</tr>
<tr>
<td>NAI</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>48</td>
<td>2.11</td>
<td>1.06</td>
<td>25.37</td>
</tr>
<tr>
<td>P&amp;ST</td>
<td>14</td>
<td>7</td>
<td>2</td>
<td>6</td>
<td>0</td>
<td>2.41</td>
<td>0.69</td>
<td>2.06</td>
</tr>
<tr>
<td>Plant Operations</td>
<td>417</td>
<td>226</td>
<td>93</td>
<td>1266</td>
<td>653</td>
<td>10.35</td>
<td>4.26</td>
<td>87.88</td>
</tr>
</tbody>
</table>

*aRecordable = OSHA definition is an occupational injury with lost, restricted workday, medical treatment (other than First Aid), or an occupational illness.

*bLD = Lost workday. (A workday on which the individual would have worked but could not because of an occupational injury or illness).

*cRD = Restricted workday. (A workday on which the individual, because of an occupational injury or illness could not perform all normal job duties or was assigned to another job on a temporary basis, or worked at a job less than full time).

The data in Table 1 is part of HCD’s commitment under the APP to measure and give feedback to LLNL on its accident reduction efforts.

Assessment of LLNL Occupational Injury and Illness Data

With respect to 1996 injury and illness data, HCD has evaluated the 204 lost and restricted workday cases reported on the LLNL 1996 OSHA Log as shown in Figs. 3–9. HCD determined that over half of the cases could be categorized as caused by activities that were incidental to the injured individual’s primary job. These injuries did not happen because of failure to follow specific safety procedures or failure to apply safety training that had been received. They involved such activities as slipping on stairs, tripping on a curb, falling off a bicycle, lifting a relatively lightweight...
item, and, in one case, reaching over to pick up a pencil from the top of a desk.

It is also true that the vast majority of accidents at LLNL that result in lost and restricted workdays (see Table 2) are of the common industrial variety (e.g., strains, sprains, cuts, and contusions) rather than the high-tech hazards associated with radiation, lasers, high pressure, high explosives, and toxic chemicals. It is therefore more difficult to target prevention efforts because the injuries are often incidental to a worker's job and because the entire Laboratory population is subject to these types of injuries.

It should also be noted that although our accident and illness rates are higher than those reported at other DOE sites, this may be a result of encouraging employees to be sensitive to and to report injuries and illnesses that are potentially occupationally related. For example, LLNL has implemented a comprehensive

![Figure 4. Lost and restricted work day cases by directorate.](image1)

![Figure 5. Lost and restricted work days by directorate.](image2)

![Figure 6. Comparison of LLNL and directorate severity rates measured in lost and restricted work days per 100 full time equivalent (FTE) employees.](image3)

![Figure 7. Frequency of Supervisor's Accident Analysis Reports per 100 FTEs.](image4)

![Figure 8. Frequency of lost and restricted work day cases.](image5)
Figure 9. Recordable cases and lost/restricted workdays by type of accident or illness as % of totals.

1996 Annual Report
Table 2. Ten most frequently reported causes of accidents on Supervisor’s Accident Analysis Reports (SAARs) in 1996.

<table>
<thead>
<tr>
<th>Cause</th>
<th>Recordable cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Individual did not recognize potential problem</td>
<td>42</td>
</tr>
<tr>
<td>2. Individual did not use sufficient care</td>
<td>39</td>
</tr>
<tr>
<td>3. Cumulative trauma—computer workstations</td>
<td>24</td>
</tr>
<tr>
<td>4. Overexertion in lifting objects</td>
<td>15</td>
</tr>
<tr>
<td>5. Individual’s constitution (weak, prior injury, medical problem)</td>
<td>11</td>
</tr>
<tr>
<td>6. Facility or equipment does not match requirements</td>
<td>7</td>
</tr>
<tr>
<td>7. Circumstances beyond LLNL control</td>
<td>6</td>
</tr>
<tr>
<td>8. Struck against stationary object</td>
<td>5</td>
</tr>
<tr>
<td>9. Overexertion, other</td>
<td>5</td>
</tr>
<tr>
<td>10. Overexertion in pulling or pushing objects</td>
<td>4</td>
</tr>
</tbody>
</table>

The ergonomics program in the past two years that stresses employee awareness of ergonomic principles and reporting discomfort associated with work tasks and computer workstations. While the Laboratory’s long-term goal is to educate employees regarding at-risk postures and the prevention of related injuries and illnesses, it must be recognized that the short-term result may be cases reported to Health Services that would have gone unreported otherwise. The ergonomic program stresses early reporting by employees. HCD believes strongly that the only way to prevent occupational injuries and illness is to know that they are occurring. This is especially true for the minor injuries (i.e., requiring only First Aid), many of which could, given slightly different circumstances, have caused a major lost-time injury.

Lastly, HCD assessment of LLNL injury and illness statistics for 1996 indicated that strains comprise approximately 27% of the injuries with lost or restricted workdays (see Fig. 9). As a consequence, HCD, Health Services, and Plant Engineering have formed a committee to review current efforts related to back care and the prevention of strains. The goal of the committee is to consolidate the efforts of the various departments using the best techniques in current preventive practices.

**Ionizing Radiation Trends**

Since 1993, the occupational radiation doses incurred at Lawrence Livermore have decreased significantly (Fig. 10). Much of this reduction has been the result of procedures implemented during the inventory reduction effort in the Plutonium Facility. Employee occupational doses increased from 13 to 15 person-rem in 1996; however, this was primarily the result of increasing workload in the Plutonium Facility and the fact that the facility was not fully operational for several months during 1995.

![Figure 10. Annual LLNL employee external person-rem data.](image-url)
V. Customer Services

This section reviews many of the routinely delivered services provided by HCD in support of its customers.

ES&H Teams

The ES&H Team services are summarized in Table 3.

Safety Labs Division Services

SLD services can, in part, be seen by the number of samples, dosimeters, measurements, instruments, and filters, etc., that were processed in 1996. Data for 1996 are summarized below by self-directed work team:

- Analytical Laboratory Team
  - Analyses = 14,949. This is a 6% increase over 1995.
- Bioassay Laboratory Team
  - Analyses = 6,725. This is a 36% increase over 1995, reflecting the full operation of the Building 254 laboratories.
- Calibrations and Standards Laboratory Team
  - Radiation instruments calibrated = 2,284 (an almost 4% increase over 1995).
- Industrial Hygiene Instruments Laboratory Team
  - Industrial hygiene instruments calibrated = 1,146. This is almost a 13% increase over 1995.
  - HEPA filters tested = 894.
- Personnel Dosimetry Team
  - Personnel dosimeters processed = 44,770. This is a 10% reduction from 1995, reflecting reduced personnel at LLNL.
  - Finger rings processed = 3,422.
  - CR-39 foils processed = 1,663.
- Radiation Measurements Laboratory Team
  - Gross alpha/beta samples analyzed = 54,951.
    This is a 9% increase over 1995.
  - Liquid scintillation samples analyzed = 9,436.
    This is nearly an 8% increase over 1995.

Table 3. Major ES&H Team services and support activities for 1996 at LLNL.

<table>
<thead>
<tr>
<th>Team 1</th>
<th>Team 2</th>
<th>Team 3</th>
<th>Team 4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Program Sq. Ft. Covered^a</td>
<td>769,557</td>
<td>1,542,533</td>
<td>2,056,046</td>
<td>1,809,962</td>
</tr>
<tr>
<td>LLNL Population Supported^b</td>
<td>765</td>
<td>2,750</td>
<td>2,850</td>
<td>4,335</td>
</tr>
<tr>
<td>Safety Procedures processed in 1996:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Operational Safety Procedures (OSPs)</td>
<td>38</td>
<td>16</td>
<td>29</td>
<td>22</td>
</tr>
<tr>
<td>Canceled Operational (OSPs)</td>
<td>29</td>
<td>17</td>
<td>40</td>
<td>6</td>
</tr>
<tr>
<td>New Facility (FSPs)</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Canceled Facility (FSPs)</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Active Safety Procedures, Dec. 1996:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational (OSPs)</td>
<td>89</td>
<td>76</td>
<td>182</td>
<td>54</td>
</tr>
<tr>
<td>Facility (FSPs)</td>
<td>11</td>
<td>11</td>
<td>27</td>
<td>14</td>
</tr>
<tr>
<td>Health Hazards Assessments/Initial Safety Evaluations/Project Work Plans Issued</td>
<td>15</td>
<td>40</td>
<td>126</td>
<td>160</td>
</tr>
<tr>
<td>Asbestos Work Permits Issued</td>
<td>8</td>
<td>4</td>
<td>41</td>
<td>24</td>
</tr>
<tr>
<td>Design Reviews</td>
<td>28</td>
<td>44</td>
<td>72</td>
<td>108</td>
</tr>
<tr>
<td>Field Reviews of Supervisor's Accident Analysis Reports (SAARs)</td>
<td>43</td>
<td>95</td>
<td>178</td>
<td>421</td>
</tr>
<tr>
<td>Number of buildings inspected</td>
<td>14</td>
<td>72</td>
<td>78</td>
<td>44</td>
</tr>
</tbody>
</table>

^a Estimate based on responsibility by Facility Associate Director (AD) (personnel and space at Site 300 are covered by Team 1).

^b Includes 1996 LLNL staff (UC employees, Supplemental Labor, and other contract employees), visiting staff and students, on-site U.S. Enrichment Corp. (USEC) personnel, and on-site DOE employees.

^c Does not include 217 SAARs that were very minor in nature and reviewed or processed by TSPD. (This was an administrative change to SAAR processing instituted by HCD in 1996. Teams still receive copies for informational purposes).
Customer Services

- Respiratory Services Team
  - Clients trained = 785. This is essentially the same as 1995.
  - Respirators tested = 3,806. This is an increase of more than 15% over 1995, reflecting increased demand from the USEC/AVLIS program.
  - Respirators processed = 11,486. This is an increase of almost 13% over 1995, again reflecting increased demand from the USEC/AVLIS program.

- Whole Body Counting Team
  - Whole body scans = 120.
  - Lung counts = 299.
  - Wound Counts = 10. All body counts decreased approximately 12% from 1995.
  - Alpha spectroscopy counts = 1,249. This is over 2.5 times the rate of 1995, reflecting the new alpha spectrometry system that was installed in 1996 in the renovated Building 254 laboratories.

Emergency Management Division

Incident Responses by EMD

EMD uses the California Fire Incident Reporting System (CFIRS) to document and report fire experience.

This system is a subset of the National Fire Incident Reporting System; information is reported in a standard, comparable format. Table 4 is in CFIRS format. It gives a breakdown of the situations found for fire-related incidents in 1996. All types of EMD incidents are summarized in Table 5.

Table 4. Fire-related incidents reported in 1996.

<table>
<thead>
<tr>
<th>Situation</th>
<th>Responses (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire</td>
<td>3</td>
</tr>
<tr>
<td>Odor of smoke</td>
<td>8</td>
</tr>
<tr>
<td>Excess heat or overheat</td>
<td>8</td>
</tr>
<tr>
<td>No cause found</td>
<td>8</td>
</tr>
<tr>
<td>Electric arc or short</td>
<td>11</td>
</tr>
<tr>
<td>System malfunction</td>
<td>11</td>
</tr>
<tr>
<td>Hazardous condition</td>
<td>14</td>
</tr>
<tr>
<td>Unintentional alarm</td>
<td>18</td>
</tr>
<tr>
<td>Good intent*</td>
<td>19</td>
</tr>
</tbody>
</table>

*Individual initiated an EMD response (e.g., 911 call, pulled manual building alarm) based on a perceived emergency situation, which upon EMD arrival/investigation was determined to not have actually existed.

Table 5. Summary of all EMD incident responses in 1996.

<table>
<thead>
<tr>
<th>Type</th>
<th>LLNL from Station 1</th>
<th>To SNL-CA</th>
<th>Site 300 from Station 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire related</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-Site Emergency Responses</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>571</td>
<td>58</td>
<td>70</td>
<td>699</td>
</tr>
<tr>
<td>Automatic Aid Calls (Fire)*</td>
<td>438</td>
<td>NA</td>
<td>8</td>
<td>446</td>
</tr>
<tr>
<td>Automatic Aid Calls (Ambulance)*</td>
<td>54</td>
<td>NA</td>
<td>1</td>
<td>55</td>
</tr>
<tr>
<td>Mutual Aid Calls b</td>
<td>42</td>
<td>NA</td>
<td>0</td>
<td>42</td>
</tr>
<tr>
<td>Total, Off-Site</td>
<td>534</td>
<td>NA</td>
<td>9</td>
<td>543</td>
</tr>
<tr>
<td>Total, All Calls</td>
<td>1,105</td>
<td>58</td>
<td>79</td>
<td>1,242</td>
</tr>
</tbody>
</table>

*A cooperative unconditional agreement to automatically provide reciprocal assistance when called by another fire department.

bAn agreement to provide assistance to another fire department that is involved in containing a major emergency in their jurisdiction, and which has depleted its fire/rescue resources and needs additional resources in order to handle the emergency.
Permits Issued by EMD

A total of 1,485 fire permits were issued in 1996 for open flame use. The Fire Permit Program is designed to prevent unwanted fires from any operation that involves an open flame. Fire fighters inspect each location and issue a permit for the use of the open flame if the operation meets certain safety criteria.

The total number of Fire Control/Alarm Impairment Permits issued by the Emergency Management Division were:

- 679 fire alarm system impairments
- 399 extinguishing system impairments.

These permits were approved and tracked by EMD Duty Fire Chiefs to ensure proper restoration of the systems. This Impairment Control Program is designed to confirm that installed fire protection systems are operational. Fire alarm or detection systems and fire extinguishing systems cannot be placed into any mode except fully operational unless a change in status is approved by the Duty Fire Chief. These impairments are tracked and the status verified daily. EMD personnel also restore these systems after use to reduce the chances of accidental water damage.

Fire Prevention Inspections

As part of the EMD fire prevention program each fire extinguisher, sprinkler system control valve, water supply block valve, and required emergency light is inspected monthly. Inspections ensure that each piece of equipment is in place and in operational condition. Each inspection is documented via bar code reader and records are maintained on a computer system. The equipment inspected during 1996 is summarized in Table 6. In addition to the monthly inspections, each fire sprinkler system is flow tested quarterly resulting in 691 sprinkler flow tests each quarter.

<table>
<thead>
<tr>
<th>Type</th>
<th>Inspections /month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire extinguishers</td>
<td>3,637</td>
</tr>
<tr>
<td>Sprinkler valves</td>
<td>837</td>
</tr>
<tr>
<td>Emergency lights</td>
<td>361</td>
</tr>
</tbody>
</table>

The division also maintains pre-plans for every building at LLNL. These contain key plans, maps, information about utilities and shut-off locations, and information about special hazards or high-value equipment. The pre-plans are provided and updated by the ES&H Team Health & Safety (H&S) Technician assigned to the building. The pre-plans are verified by Division Fire Fighters during each monthly inspection.

EMD Dispatch Center (Building 313) Activities

Dispatch center activity is usually measured using the term “demands for service.” That term refers to a transaction that requires the dispatcher to take an action involving dispatching, alerting, or notifying a person, LLNL organization, external agency, or apparatus (e.g., City of Livermore Fire Department). The second measure of dispatch center activity is the number of telephone calls handled, including 911 emergency calls.
Telephone calls may be a demand for service or the dispatcher may simply provide information to the caller. Table 7 describes the activity of the EMD Emergency Dispatch Center in 1996 by day of the week.

Table 7. EMD Dispatch Center activity in 1996 by day of the week.

<table>
<thead>
<tr>
<th>Day of week</th>
<th>Demands for service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday</td>
<td>587</td>
</tr>
<tr>
<td>Monday</td>
<td>918</td>
</tr>
<tr>
<td>Tuesday</td>
<td>978</td>
</tr>
<tr>
<td>Wednesday</td>
<td>1,031</td>
</tr>
<tr>
<td>Thursday</td>
<td>1,060</td>
</tr>
<tr>
<td>Friday</td>
<td>949</td>
</tr>
<tr>
<td>Saturday</td>
<td>767</td>
</tr>
<tr>
<td>Total</td>
<td>6,290</td>
</tr>
</tbody>
</table>

Cost of Fire Protection

Government property is uninsured for property loss resulting from fire. The ultimate cost of any loss, with or without replacement, is borne by the American taxpayer. This, and the unique and critical nature of many LLNL facilities, places a premium on the effectiveness of Lawrence Livermore firefighting capabilities. In order to assure that the Fire Department is cost effective, HCD evaluates the cost of fire protection as a ratio to the value of property protected. Table 8 summarizes the cost of emergency response over the past four years.

Self-Contained Breathing Apparatus

Over 100 self-contained breathing apparatus (SCBA) units were checked, serviced, and rebuilt by EMD. The division maintains all SCBA and supplied air-line apparatus used for various specialized operations at LLNL in accordance with OSHA, ANSI, and NFPA requirements.

Classes Given by Hazards Control

A total of 3,312 H&S classes were given and 14,722 individual course completions were entered into the Laboratory Repository of Completed Courses (LROCC), the LLNL employee education tracking system. This includes 1,109 completions of courses provided in CBT (Computer-Based Training) format and 472 in WBT (Web/LLNL Intranet Based Training).

Table 8. Cost of emergency response in total dollars and as cost of LLNL property vs cost of protection per $100 value.

<table>
<thead>
<tr>
<th>Year</th>
<th>Emergency response cost ($million)</th>
<th>Value protected ($million)</th>
<th>Cost, EMD protection/$100 value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>$4.65</td>
<td>$4,280</td>
<td>$0.11</td>
</tr>
<tr>
<td>1994</td>
<td>4.65</td>
<td>4,701</td>
<td>0.10</td>
</tr>
<tr>
<td>1995</td>
<td>4.97</td>
<td>5,174</td>
<td>0.10</td>
</tr>
<tr>
<td>1996</td>
<td>4.88</td>
<td>5,686</td>
<td>0.09</td>
</tr>
</tbody>
</table>

A Radiation Control Trainer gives instructions in the proper way to conduct radiation surveys in a laboratory to an H&S Technician in the ET&SAG Radiological Worker training facility.
format, of which 82 were taken at the HCD CBT Center. These numbers reflect several conflicting drivers:

- The number of courses presented has more than doubled in the last three years because each CBT/WBT completion is a “course,” more refresher courses are available, more classes are tailored to specific audiences, and class sizes are tending to be smaller.

- Courses have been split into an “education” session and a “training” session to reflect the fact that hands-on training sessions are limited by equipment availability to a few students at a time while classroom education sessions can accommodate many more.

ET&SAG also noted in 1996 that most students who have taken advantage of the new electronic course formats have been very pleased with the results and feel that this is the right way to go. Early complaints about problems running the software have been reduced as conflicts between different sets of software and hardware were ironed out. Students also noted that some workstations were provided with enough adjustment to accommodate handicapped persons. Consideration is also being given to the inclusion of text in software that uses sound to deliver important safety information so that deaf students can also use this format. The introduction of new equipment in the classrooms has allowed direct color projection of computer-generated images and has been noted as an improvement in some comments received from students.

Preliminary Hazards Analysis and Safety Analysis Reports

ET&SAG was a major contributor to the Performance Measure grade received from DOE for LLNL compliance with the agreements on the PHA and SAR process at Livermore reached by the UC and DOE. In addition, during 1996, ET&SAG

- Completed telephone screenings of 158 facilities that appeared to be exempt from hazard classification (e.g., office trailers, general storage areas)

- Advised construction project leaders that Safety Analysis documentation was not required for two Site 300 projects

- Documented three proposed operational changes in Building 239 and one proposed change in Building 298 for addition to the existing safety basis for these facilities

- Documented proposed changes for Buildings 132S, 194, and 197 as being within their existing safety basis

- Reviewed the existing safety basis for Buildings 132N, 153, and 43, and concluded that they were still appropriate for their operations

- Wrote Preliminary Hazard Analyses for Buildings 132S, 166, 223, 281, and 294

- Contributed to the completion of Safety Analysis Reports for the Site 300 Environmental Test, Materials Management, and Firing Area Facilities, and for the NIF Preliminary Safety Analysis Report.
VI. Support to Significant LLNL Incidents

Small Acid Fire in Building 431

On January 19, 1996, a fire involving fuming nitric acid occurred in Building 431, Room 1309. The fire started when a container of acid stored in a metal cabinet leaked and reacted with its shipping/packing materials (e.g., cardboard). The 10 liters of fuming nitric acid, which was still in its original shipping containers, was purchased by an experimenter for future use in another facility. The material had been in storage in the building for only two days.

Two fire sprinklers were activated and contained the fire. EMD fire units responded and used a very small amount of water to extinguish the fire within the cabinet. As a precaution, a Twin Valley Mutual Aid request was initiated by EMD for backup fire department support. It was quickly determined that the units from outside the Laboratory were not needed and they were released. ES&H Team 4 and EPD also responded to the incident.

Damage was minimal. Approximately 2,200 gallons of residual fire sprinkler water ran into the basement of the building and a small amount, approximately 200 gallons, ran into the Room 1310 sump. Four Laboratory employees—two Protective Service Officers, one Mechanical Technician, and one EMD fire fighter—were sent to Health Services for evaluation of possible smoke inhalation and skin irritation. All were examined and released back to work except the fire fighter, who received medical treatment for localized contact dermatitis about the neck and shoulders.

While property damage was minimal (estimated at $2,500), a formal Incident Analysis Committee was convened to review the incident and make recommendations to prevent the occurrence of similar incidents.

Laser Eye Exposure

ES&H Team 2 assisted in the investigation of an incident in Building 171 where a locksmith was exposed to a beam from a laser that had inadvertently been left on in a room without door interlocks. Fortunately the laser, which was operating at low power, did not cause any injury to the locksmith. However, the unusual sequence of events prompted program management to conduct a formal internal review of the operation. This review identified the need for additional training for new Lead Experimenters in their responsibilities for implementing the work planning elements of Chapter 2 of the LLNL Health & Safety Manual. A course to address this issue is being assembled by the Program Assurance Office and Team 2.

Uranium Reaction Vessel Failure

On the evening of August 8, 1996, a failure occurred in a experimental apparatus, located in Building 177, Room 1014, that was designed to oxidize uranium product. The reaction vessel failed and there was a release of uranium within the room and adjacent hallway. However, there was no release to the environment. EMD fire units responded to the incident as did the off-shift Health and Safety Technician. The Division Leader for ES&H Team 2, a Team 2 Health Physicist, and a Health and Safety Technician were called back to the Laboratory to provide additional emergency response support. Team 2 personnel performed initial surveys of the individual involved, of Fire Department equipment, and the building in order to locate and contain the contamination. In addition, SLD staff provided analytical support to assess the situation. It was determined that one worker in the building had received a low-level (<10-mrem CEDE) internal exposure when he entered the room to shut down the experiment and minimize the spread of contamination. An in-depth internal review of the incident was conducted by the program in order to understand the causes of the failure and subsequent release and to prevent any reoccurrence.

Employee Injured by Steel Plates

On Labor Day, an employee disassembling a large experimental setup in Building 241 was trapped under two 450-lb steel plates after he disconnected them from their vertical position. Using the tools within his reach, he eventually freed himself from the 900 lb of steel and crawled to the nearest phone where he dialed 911. The employee, who had been working alone, was transferred by the EMD Paramedics to Valley Care Medical Hospital. He suffered a shattered right ankle, a broken left knee, and a laceration to his left forearm. The incident was reported to the DOE as an Unusual Occurrence. The Division Leader for ES&H Team 2 served on the LLNL Incident Analysis Committee that issued a report with recommendations for preventing similar incidents.
Support to Significant LLNL Incidents

West Inner Loop Road Automobile/Pedestrian Accident

An AIS Systems Analyst was struck by a north-bound pickup truck while crossing West Inner Loop Road in a crosswalk east of Building 271. The employee was thrown approximately 25 feet. The vehicle was operated by a construction contractor. Fire/rescue units from EMD and staff from ES&H Team 4 responded to the incident. Initial assessment by EMD Paramedics determined that the injured employee had received multiple fractures of the pelvis and other internal injuries. She was transported to the Eden Valley Hospital Trauma Center by helicopter and admitted to the Intensive Care Unit. The driver of the truck was not injured. Due to the severity of the injuries, the California Highway Patrol took over the formal investigation of the accident. They determined that inattention on the part of both the driver and pedestrian contributed to the accident. An Occurrence Report was filed with the DOE, and an LLNL Incident Analysis Committee was formed to perform an internal review of the accident.

Internal Uptakes of Radioactivity

The TSPD Internal Dosimetry Coordinator and SLD analytical staff provided internal dosimetry follow up to two minor contamination incidents: (1) the failure of the uranium reaction vessel in Building 177 and (2) the inadvertent compaction of contaminated waste in Building 491. The follow-up bioassay indicates that a small intake may have occurred during the Building 177 incident. It appears that the dose will be below the DOE reporting/recording level of 100 millirem. Follow-up lung counts and bioassays following the waste compaction incident indicated that no significant intakes occurred.

Failure of Reaction Vessel or Attached Piping

During an experimental run of a Molten Salt chemical reaction vessel, a mechanical failure of the reaction vessel or attached piping occurred. The purpose of this work was to develop a process for the destruction of energetic material. Only surrogate material (i.e., non-energetic material) was being run in the reactor at the time of the failure. This failure resulted in the release of a spray of high-temperature (up to 800 degrees centigrade) molten salt in an approximate arc of 270 degrees into the room. Three people were in the room at the time but, fortunately, were not in the path of the spray. There were no personnel injuries resulting from this incident. The operator immediately shut the chemical reaction vessel down and put it into a stable condition. ES&H Team 1 assisted in securing the area and preventing access to it pending an incident investigation.

Off-Site Emergency Support

HCD staff assigned to the DOE Radiological Assistance Program responded to a callout request from the U.S. Customs at the San Francisco Airport after they discovered several suspicious containers in a warehouse near the airport. After an in-field evaluation with portable measuring instruments, the HCD response team determined that the containers were empty shipping containers for uranium hexafluoride, and posed no hazards.
VII. Professional Publications and Presentations

1996 was another year in which HCD staffers published many important health and safety related papers, articles, and other professional documents. Here is a partial list of some of the works and presentations given by members of the department:

Bergman, Werner, Jan K. Freethold, and James W. Slawski, “Potential for HEPA Filter Damage from Water Spray Systems in Filter Plenums,” presented at the 24th DOE/NRC Nuclear Air Cleaning and Treatment Conference.


Bergman, Werner, K. Wilson, K. Staggs, and D. Wapman, “Development of an Air Cleaning System For Dissolving High Explosives from Nuclear Warheads,” presented at the 24th DOE/NRC Nuclear Air Cleaning and Treatment Conference.

Bergman, Werner, K. Wilson, J. Elliott, B. Bettencourt, and James W. Slawski, “In-place HEPA Filter Penetration Test,” presented at the 24th DOE/NRC Nuclear Air Cleaning and Treatment Conference.

Bergman, Werner, Requirements for a Cleanable Steel HEPA Filter Derived from a Systems Analysis, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-ID-125048).


Herr, Monty L., “Industrial Hygiene Society Unification,” presented at the Orange County Local Section, American Industrial Hygiene Association.


Kelly, R., “Chronic Trichothecene Mycotoxicosis May Be Indistinguishable from the Chronic Fatigue Syndrome,” presented at the American Association for Chronic Fatigue Syndrome Medical Conference, San Francisco CA, October 1996.


Zalk, D., J. Tolley, and Yong Kim, “Grassroots Ergonomics to Modify Custodial Training Procedures,” accepted for 1997 publication by Professional Safety, the journal of the American Society of Safety Engineers.

Zalk, D., and James Martin, “Carpenter shop wood dust control—practical experience to reduce hardwood dust exposures below the ACGIH TLV,” accepted for 1997 publication by Applied Occupational and Environmental Hygiene.
VIII. Areas of Concern

Inspection and Recertification of Pressure Vessels and Systems

Significant downsizing in the High Pressure Laboratory has contributed to the number of pressure vessels and systems that are overdue for triennial reinspection. More than 120 are overdue now and the risk will increase as more vessels and systems become overdue for inspection or recertification. HCD will be working with Program Assurance Managers to help them develop efficient approaches (i.e., removing from service, derating, inspecting) and priority-based schedules to resolve the backlog of vessels that are due for inspection.

Compliance with Radiation Safety Training Requirements

In 1996, LLNL assessed the extent of its compliance with the radiation safety training requirements of 10 CFR 835, Occupational Radiation Protection. In June, 49% of LLNL employees and contractors had completed their training requirements. A major effort was initiated to bring all workers into compliance. By the end of August, 98% were in compliance. When received again in October, the rate had dipped to 93%, chiefly because of retraining schedules. HCD then again coordinated the effort to bring all workers into compliance. Laboratory managers and supervisors must ensure that both worker training requirements are met and that workers are current on their training in order to be in compliance with 10 CFR 835.

Department Facilities

Many of the HCD buildings and associated equipment are old and becoming less reliable due to constraints on the LLNL maintenance budget. The cost associated with the operation of these energy-inefficient facilities is also rising. In addition, concern about accidents or injuries from aging equipment is also increasing.

DOE Beryllium Regulation

The DOE has proposed formal rule making for beryllium; federal regulations are expected to be promulgated within the next year. Early drafts of the proposed regulation contain requirements for a formal As Low As Reasonably Achievable (ALARA) program and increased medical surveillance for beryllium workers. At this time, DOE is not proposing a reduction in the present permissible exposure limit of 2 micrograms per cubic meter of air. Since new regulations would be promulgated as a law, the changes would not be subject to the Work Smart Standard or the UC/DOE contract modification processes. If the regulation remains as originally drafted, it would require significant additional expense to fully implement at the Laboratory. It would require a formally documented ALARA program, significantly increased worker monitoring, and detailed characterization and documentation of present and past beryllium handling facilities.

Rise in LLNL's Injury and Illness Rates

As discussed in both Sections IV and IX of this report, the overall injury and illness rates (frequency and severity) increased in 1996. Although LLNL rates are lower than the rates found in private industry, they are still above the average for other DOE R&D contractors. The fact that LLNL rates have been above the DOE average for the past several years, and increased in 1996, is of concern to both HCD and Laboratory management. HCD will continue to work with directorate management and personnel on identifying ways and approaches to reduce the potential for accidents, with particular attention focused on the philosophy and elements expressed in the APP.

Safety Analysis Support

The need for maintenance of existing documentation and support for safety basis development for new programs and/or operations continued through 1996. Concern for the formal annual or triennial reviews and more formal linkage with OSPs, FSPs, and TSRs, and USQ-like reviews will surface as the G&A budget is reduced further (5% scheduled for FY97). The ES&H Assurance Managers are aware that the programs will need to fund greater percentages in FY97, even more in FY98, and perhaps eventually all support in this area.
IX. Review of Concerns from the 1995 HCD Annual Report

Off-Shift Health & Safety Technician Program

In addition to EMD response capabilities, HCD has a Health and Safety Technician on site during off-hours (including weekends and holidays) to provide immediate support to emergencies (e.g., Hazmat incidents, check radiation alarms). In addition, this technician performs limited programmatic support, such as monitoring tours of certain Laboratory areas (e.g., Plutonium Facility, Animal Care Facility). HCD became concerned in 1995 that this function, which had been funded as an overhead cost at 4.5 FTEs, would have to be terminated if non-overhead funding sources could not be identified. HCD strongly felt that terminating the off-shift Health and Safety presence could seriously impact response times to ES&H emergencies and create a potential for turning minor incidents into high-visibility, high-consequence occurrences.

In 1996, several directorates that use the off-shift support on a regular basis continued to provide sufficient funds to support the off-shift technician program. Using computer logs from the EMD Dispatch Center, which tracks the activities of the off-shift technician, HCD has improved its process for determining where the technicians are spending their time. Major programmatic users of off-shift technician support are now requested to provide annual allocations based on their usage of the off-shift services. However, since this is not a recharged service, infrequent users do not contribute to the cost of providing the Laboratory with this service. At this time, HCD has no plans for exploring other allocation schemes to better apportion the cost of the off-shift program.

DOE Order Reduction Effort

In the 1995 annual report, the hope was expressed that the DOE Order reduction effort would lead to less prescriptive DOE requirements. However, in some areas, the new orders added more performance items for the Laboratory, a potential increase in LLNL operating expenses. For example, the revised transportation safety order would require LLNL to package and handle all internal (i.e., within the boundaries of LLNL-Livermore or LLNL-Site 300) movement between buildings of hazardous/radioactive materials as if they were being shipped off site onto a public roadway. Meeting this requirement would add several hundred thousands of dollars annually to the cost of moving items around LLNL.

The consolidation and conversion of some DOE orders into federal regulations (e.g., 10 CFR 835) was a concern. Noncompliance by LLNL becomes not just a contractual issue between UC and the DOE, but turns into a potential violation of federal law. This could subject not only UC/LLNL as an institution but also individual UC/LLNL managers to civil or criminal prosecution. Given the potential sanctions, much more attention is given to the development by HCD of detailed implementation plans and timelines for LLNL compliance.

Also, the less prescriptive mandates are more subjective and open to interpretation.

In 1996, the “necessary and sufficient” process, the concept by which DOE and its contractors would jointly identify the ES&H standards that are both necessary and technically sufficient to cover work activities, was officially adopted by the DOE. Under the new name, Work Smart Standards, this process and the related concept, Integrated Safety Management System (ISMS), were determined as the means by which many of the concerns associated with the Order reduction process could be addressed. The HC Department Head invested a considerable amount of effort representing both LLNL and UC in the development of the process with the DOE. The ISMS concept focuses on management's approach to ES&H and incorporates safety into all levels of the work planning process. The approach to ISMS adopted by the DOE for use across the DOE complex is very similar to that already in use at LLNL; it is discussed in Chapter 2 of the LLNL Health & Safety Manual. In the WSS process, DOE and UC/LLNL subject matter experts evaluate the specific work under way at LLNL and reach a mutual consensus on the specific safety standards that will apply at the Laboratory. This is a slightly different approach from the past “one size fits all” approach typical of DOE Orders.
Safety Analysis Support

In 1995, HCD noted a continuing need for effort in the safety analysis area, directed toward maintenance of existing documentation and support for development of the safety basis for new programs or operations. This normally would include a requirement for formal annual or triennial reviews of safety analysis documents and a more formal link between these documents and the facility documents/requirements, which include OSPs, FSPs, and Technical Safety Requirements (TSRs). Concern was raised because HCD work force plans called for the significant reduction of G&A funding of the safety analysis staff and, consequently, its capability to prepare safety analysis documentation for program customers.

In 1996, progress was made towards establishing recognition by LLNL program managers of the importance of maintaining the safety basis developed for their operations over the past five years. The temporary shut down of the LLNL Plutonium Facility after a determination that some elements of the facility's approved SAR and TSRs were not being performed properly validated HCD's concern, and after the shut down, the department received numerous requests from program managers to perform Unresolved Safety Question (USQ)-like reviews of their operations.

Hazards Control Design Review

The lack of a formal HCD review requirement for all contractor submittals on major construction projects was identified as a concern in 1995. While design reviews by HCD are required for conceptual design and overall design, there is no signature requirement for subsequent contractor submittals of detail drawing packages and work plans (e.g., fire sprinkler system designs, shop drawings, asbestos abatement plans).

In 1996, the joint HCD/EPD/PE Working Group, which was chartered by the heads of these three departments to address their ES&H interaction issues, developed a strategy to improve the design review process. A key element was a series of inter-departmental classes, taught by staff members for staff members, so HCD, EPD, and PE staff could better understand the design process from the point of view of all three organizations. It was particularly valuable to have staff members explain their part in the design process (e.g., overview of drawings vs detailed line-by-line re-analysis of drawings), their respective drivers (e.g., code, standards, customers), and their expectations (e.g., immediate resolution of early design phase comments vs resolution during final design). The classes were well received. The joint working group continues to study process-related concerns to properly identify and correct ES&H issues during all phases of project planning, design, and construction.

Inspection and Recertification of Pressure Vessels and Systems

Significant downsizing in 1995 of the High Pressure Lab contributed to the number of pressure vessels and systems that are overdue for triennial reinspection. At the end of 1995, over 100 vessels and systems were overdue for either inspection or recertification. This continues to be a concern (see additional discussion in Section VIII of this report).

Available Resources vs Legacy Facility Issues

Several concerns dealing with the disposition of excess buildings and trailers at LLNL have been identified over the years. These include the lack of funding to cover routine ES&H shutdown, surveillance, and maintenance activities; identification of an individual to represent the institution (i.e., LLNL) when it takes over ownership from an LLNL program organization; lack of funding to dispose of or demolish facilities returned to the institution; and too many groups working this issue without sufficient communication between them.

In 1996, Space and Site Planning, PE Maintenance and Operations, and the ES&H Teams actively sought solutions to these issues. Under the coordinated efforts of the Facility Assessment Team led by Space and Site Planning, procedures and policies were established to address these and other legacy/institutional facility issues. The ES&H Teams also worked to clarify the process by which facilities are transferred from one team's jurisdiction to another.
Review of Concerns from 1995

Injury and Illness Statistics

In 1995, HCD noted that in the atmosphere of cost cutting and downsizing at LLNL, the “do more with less” approach, if done without proper consideration for ES&H concerns, could produce unwanted outcomes. A review of injury and illness statistics revealed cases where cost concerns contributed, at least indirectly, to injuries and illness. For example, an individual unaccustomed to moving furniture and heavy boxes was asked to do so to save on the cost of moving an office.

For 1996, HCD worked informally with program personnel to emphasize that shortcutting safety in order to save time and/or money was inappropriate and risked the health of employees. The philosophy of not cutting corners when it comes to ES&H was reinforced by the Director during an address to the Laboratory, and by the various ADs at staff and directorate meetings.

A review of LLNL injury and illness statistics for 1996 is found in Section IV of this report. It shows that the Laboratory’s overall injury rates unfortunately increased from 1995 to 1996. While the informal approach to prevention may have had some effect (i.e., rates could have been higher), HCD is concerned over the rise in the Laboratory accident rate. In 1997, HCD will work with the various LLNL programs on ways to instill the philosophy of the APP and to implement its eight essential elements, as discussed in Section I.

Criticality Safety

In 1995, staffing for Criticality Safety was identified as a concern by HCD. Increased staffing in this area was made more difficult given the limited number of qualified criticality safety experts, not only at LLNL but in the world. Hiring was also impacted by a general unwillingness of external candidates to take a limited term UC or contract position at LLNL.

In 1996, critical reviews of the LLNL Criticality Safety effort by both the Laboratory and DOE confirmed HCD concerns. A Criticality Safety Group was reestablished in the department, whose Leader reports directly to the HCD Department Head. The CSG was authorized by the Director’s Office to hire several criticality safety engineers from outside LLNL as career indefinite UC employees—including the new group leader. The group spent 1996 assessing the state of criticality safety at LLNL and supporting programmatic work, not only in the Plutonium Facility but in other programs where nuclear materials were being used. And while there has never been an injury related to a nuclear criticality event at LLNL, the consolidation of the criticality safety engineers into a single group improves the technical base and allows for peer review of the very complex analyses that are needed to assure that one never occurs.
X. Plans for 1997

Administrative Services Division

ASD has scheduled several HCD facility-related projects for 1997. Significant ones are to:

- Re-roof Building 253, scheduled for the summer of 1997 as part of an LLNL line item project
- Review the condition of the Building 254 boiler and exhaust system. If any problems are identified, work on solutions and identify funding for corrective actions
- Replace the air conditioning chiller in the Building 253 center wing
- Replace the heating boiler in the Building 253 east wing.

Criticality Safety Group

For 1997, this group will continue to build up the required resources needed to provide effective support to LLNL and to maintain itself as a national resource for DOE in accordance with the HCD budget and work force plan. Various activities are planned for 1997 to reduce the backlog of work, enhance core capabilities, and maintain and nurture professional growth of staff members.

Education, Training, and Safety Analysis Group

ET&SAG will fully integrate all the Emergency Management courses into the HCD systems for record keeping and course management. Significant effort will be made to add more WBT and CBT courses, as replacements for existing classroom instruction or new classes to address programmatic requests.

A significant level of hands-on training became a major part of radiation control training courses taken by HCD Health & Safety Technicians last year. We will expand this concept this year, either by augmenting existing courses or by adding hands-on training as a companion course.

ET&SAG will continue with the review and upgrade of safety basis documentation for LLNL facilities that were last reviewed more than five years ago.

ET&SAG expects to complete the revision of H&SM Supplement 6.06, “Safety Analysis,” and write guidance documents for the various tasks (e.g., change management documentation, hazard analysis process and techniques) performed by the safety analysts to attain a higher degree of uniformity in the analysis products.

Emergency Management Division

Outsourcing of LLNL Fire Department

After extensive review of the merits and issues, HCD formally recommended to the Associate Director for Plant Operations that the emergency operations functions (i.e., Fire Department) within EMD be consolidated into one of the municipal Fire Departments surrounding the Laboratory. The proposal, which was subsequently approved by the AD for Plant Operations, the Deputy Director for Operations, and the Director, would provide cost savings to the Laboratory with no decrease in the level of services. The consolidating agency would have to agree to conditions that would ensure that the change would be transparent to the Laboratory as a whole. The consolidation would include the transfer of the Laboratory fire fighters to the consolidation agency. LLNL Chief officers (Fire Chief and Assistant Chiefs) would remain Laboratory employees and oversee on-site emergency operations. Negotiations with the two fire agencies who are closest to the Laboratory will begin in 1997.

ES&H Teams

ES&H Team 1 members will begin focusing more attention on the high volume of construction-related activities planned at Site 300. The CFF, Explosive Waste Treatment Facility (EWTF), Pit 6 Capping Project, two additional explosives magazines, and a number of other general Site 300 facilities upgrades will begin in 1997.

ES&H Team 2, at the request of program management, will increase its level of support to the AVLIS project. Team 2 expects to hire more staff in the summer of 1997 to provide coverage to an aggressive program run schedule planned by AVLIS management. Additional HCD resources, such as respirator services, bioassay analysis, and off-shift Health and Safety Technician coverage may also be required to support the increased AVLIS work load.

ES&H Team 2 will continue to support the NIF project, with increasing emphasis on construction aspects. Team 2 will provide construction safety oversight of the construction contractor’s safety program. The NIF Title 2 design packages for the conventional facilities (i.e., laser bay, target area, and optical assembly buildings) will be completed in the first half of 1997; they require review by Team 2, which will be a significant effort. In addition, Team 2 will continue supporting the preparation of numerous permits and
studies required for the NIF, again a significant task given the magnitude of the project.

An Industrial Hygienist for ES&H Team 3, working with a researcher from the C&MS Directorate, received funding for a pilot project to determine the level at which adventitious peroxides become dangerous. The project will examine seven common peroxidizable chemicals, with the goal of establishing a science-based administrative limit for peroxides in solvents.

ES&H Team 4, as well as the other teams, will be developing or reviewing the career development plans of their field Health and Safety Technicians. The intent is to identify ways to help technicians prepare for possible promotion to professional status in an ES&H discipline. The minimal educational requirement for ES&H disciplines is a B.S. degree in engineering or a natural science, and technicians without such degrees would have to obtain one. However, HCD recognizes that academics are only a portion of what makes a competent professional. Therefore, technicians with high levels of skills, knowledge, and abilities who are interested in entering the Scientist and Engineering rank at LLNL will need mentoring to enhance their capabilities and learn the detailed technical knowledge of a particular ES&H discipline. This will provide them with a possible avenue for competitive advancement, as well as allow the ES&H Teams to fill positions where staffing shortages exist with qualified individuals from within HCD.

Integrated Safety Management/Work Smart Standards Project Office

The WSS project will begin in mid-1997. The Work Smart Standards project, which is part of ISM, is designed to improve the management of ES&H within the DOE community and improve the working relationship between DOE and its contractors. The WSS project will also serve as the mechanism for better aligning the ES&H requirements contained in the UC/DOE contract for operating LLNL with the ES&H standards currently used in the private sector. While the basic principles of the process are not new to the Laboratory, this will be the first time that a formal process is used by Laboratory workers/managers in partnership with the DOE to jointly determine the appropriate set of ES&H standards for work performed at LLNL. The whole process, which is coordinated by HCD, will take approximately eight months to complete.

Safety Labs Division

Work for Sandia National Laboratories

The SLD Respiratory Services Team is expected to begin maintaining, testing, and issuing respirators and training and testing respirator users for Sandia National Laboratories, California. This will relieve SNL/CA of some of the cost associated with maintaining this service for their small number of respirator wearers and allow LLNL to provide the service within the existing program. This should be a net positive for both organizations.

Sample Tracking System Upgrade

The upgrade to the HCD Sample Tracking and Records (STAR) system for radiological and chemical swipe samples taken in the workplace should be fully implemented in early 1997. It will greatly reduce the time required for sample data entry. This is a continuation of the work of a multidisciplinary committee that initiated a new computer screen look and interface for the STAR database. New forms for swipe samples were developed, and system training has begun. To ensure correct use, the upgraded STAR2 system is only installed on users’ computers after they complete the 8-hr training course.

DOE Accreditation

Both the SLD Bioassay Team and the Whole Body Counting Team are expected to be audited by the DOE Laboratory Accreditation Program for Radiobioassay.

Support to LBNL

The SLD Personnel Dosimetry Team members are training their counterparts at LBNL to use the REMS (Radiation Employee Measurements System) computer program that was developed at LLNL to maintain employee dose records.

Radiation Measurements Laboratory

The SLD Radiation Measurements Laboratory expects to offer two new services using liquid scintillation counting: (1) a triple label measurement of $^3$H, $^{14}$C, $^{32}$P on a single sample and (2) gross alpha measurements and tritium on a single sample.
Visitor Dosimeters

The Personnel Dosimetry Team is working with Safeguards and Security to develop the basis for automating the registration of visitors who require dosimeters. This automatic system will eliminate the need for visitors to provide duplicate information.

Special Projects Division

A proposal was written and accepted for SPD to design, fabricate, test, and deliver a portable mass spectrometer system to the NASA Kennedy Space Center. Funding was received to build this unit in FY97. This project is being done in conjunction with Tuskegee University.

SPD will continue to support the LLNL Nuclear Stockpile Stewardship Program by providing broad-based technical, ES&H, and regulatory expertise for experiments to be conducted at the Nevada Test Site. SPD expertise will be applied at NTS and to complementary work at Site 300. This will be the second year that SPD has played a substantial role in the approval and conduct of this national security program.

In cooperation with the Fission Energy System Safety Program (FESSP) in the Energy Programs Directorate, the division will perform research for the development of a non-intrusive system for the detection of unauthorized radioactive material, radioactive contamination, and/or certain plant-derived drugs in vehicles. SPD has particularly well qualified staff and UC/LLNL holds the patent on the radiation detector used in this application. The division will also continue to provide regulatory, technical, and ES&H support to DOE through FESSP for the transition of the DOE gaseous diffusion plants to Nuclear Regulatory Commission jurisdiction. This work is the continuation of SPD and FESSP efforts for over five years to assist DOE in revamping the national enriched uranium supply system.

A proposal will be prepared for the Department of Defense (DOD) to develop a portable sampler for biological agents. This project, if funded by the DOD, would use SPD personnel to develop and test a prototype sampler in 1997.

SPD will also be working to obtain DOE approval to receive the HEPA filter qualification test equipment being released by Rocky Flats. This additional equipment will make LLNL the only DOE facility that can both qualify and certify HEPA filters for use in DOE facilities. This is of significance since HEPA filter manufacturers cannot sell filters for use in DOE operations without first qualifying them, and it would also make LLNL the most comprehensive HEPA filter test, qualification, and development facility in the United States.

Technical Support and Policy Development Division

Implement Safety Program for Radiation Generating Devices

Hazards Control plans to implement a new RGD Safety Program by combining the assessment and controls for “incidental” radiation producing devices, x-ray machines, and accelerators into a single document. The streamlined program utilizes a new approach to classifying RGDs; it is based on the hazard potential of the device rather than on the energy of the machine or whether the radiation is produced intentionally or as a by-product of use. The program is in the review process, and when fully implemented should significantly enhance worker safety and LLNL’s ability to demonstrate compliance with regulations covering RGDs.

Pressure Vessel Testing and Inspection

Hazards Control is planning a major effort to significantly reduce the number of pressure vessels and systems that are overdue for retesting and reinspection, which now stands at 120. HCD will be working with program assurance managers, other program personnel, and the High Pressure Laboratory to help them develop efficient approaches (e.g., removing from service, derating, inspecting) and priority-based schedules to resolve the backlog of vessels that are due for inspection.

Injury/Illness Record-Keeping System Upgrade

TSPD, SLD, and representatives from the ES&H Teams will be exploring options for upgrading the computer system HCD uses to track occupational injuries and illness, as well as generate statistics for trend analysis and required reports for transmittal to the DOE. The new system is expected to be on-line by the end of 1997. It will interact with LLNL personnel and medical databases and allow for future enhancements, such as direct supervisory input into injury/illness reports. Computer systems developed by other DOE contractors and commercially available software will be evaluated for their suitability for use at LLNL.
Appendix A

Administrative Services Division

The Administrative Services Division (ASD) has 8 employees. It is tasked with providing support to the Hazards Control Department in the following areas: Human Resource/Personnel Management, Financial Management, and Facilities and Quality Assurance Management.

Criticality Safety Group

Formed in 1996 as a new group in HCD, the Criticality Safety Group provides focused institutional management oversight and support of the nuclear criticality safety element in the Laboratory’s ES&H Program. The 11 CSG employees provide technical and programmatic support in the area of nuclear/criticality safety through the ES&H Teams to various facilities and programs at the Laboratory.

Education, Training, and Safety Analysis Group

The Hazards Control Education, Training, and Safety Analysis Group with 23 employees performs three primary functions.

First, ET&SAG instructs Lawrence Livermore personnel about safety and health hazards, regulatory requirements, and additional LLNL management controls that are required to conduct hazardous activities safely. This division also teaches practical solutions for responding to and controlling hazards and provides mandatory training (e.g., 10 CFR 835, OSHA) to Laboratory personnel. The division trains over 14,000 individuals and gives more than 3,000 classes every year.

Second, ET&SAG provides the technical expertise needed to conduct formal hazard and safety analyses of LLNL operations and facilities and acts as liaison with DOE personnel to reach agreement on the required format and content of the resulting reports.

Third, the ET&SAG operates the Safety Glasses Office and manages the Safety Shoe program for LLNL. These activities include dispensing prescription and nonprescription impact safety glasses, laser safety glasses, computer workstation glasses, and safety shoes to LLNL and some contract employees.

Emergency Management Division

The Emergency Management Division has 56 employees. The division is divided into three main functional areas: Emergency Preparedness, Emergency Operations, and Occurrence Reporting. The emergency preparedness and occurrence reporting functions were transferred to the division from the NAI (Nonproliferation/Arms Control & International Security) Directorate in mid-1996.

The emergency preparedness function of the division provides the Laboratory with guidance and management to ensure that the Laboratory is prepared to respond to and manage any on-site or significant off-site incident resulting from or affecting Laboratory personnel or activities. As part of this function, the division conducts site hazard evaluations, develops and maintains the LLNL Emergency Plan, maintains and coordinates activities of the LLNL Emergency Management Center, provides oversight and direction to the LLNL Self-Help Program, and coordinates emergency response training, drills, and exercises.

The emergency operations function of the division, more commonly known as the LLNL Fire Department, responds 24 hours a day to emergency incidents on the Lawrence Livermore sites, at the SNL-CA properties, Site 300, and in the surrounding community. As part of this function, the division provides nonsecurity emergency dispatch and response, fire prevention, liaison and coordination with emergency agencies of the communities surrounding LLNL, and emergency planning.

The division’s modern emergency dispatch center located in Building 313 handles all nonsecurity dispatching for the Laboratory. This includes:

- Dispatching fire department units, including paramedics, at both LLNL Fire Stations—# 1 (Livermore) and #2 (Site 300)
- Serving as the “911” answering point for all Laboratory emergency calls
- Monitoring the site-wide Health and Safety Alarm System
- Operating the Building Emergency Voice Alarm/Notification system
- Serving as the off-hours contact point for off-site response groups located at LLNL, such as NEST, ARG, Radiological Assistance Program, Federal Radiological Monitoring and Assessment Center, and Threat Credibility Assessment Center
- Receiving and dispatching requests for mutual aid for the Twin Valley Area and throughout Alameda County
- Dispatching and tracking the off-hours Hazards Control H&S Technician

Hazards Control Department
Coordinating the fire protection system impairment control process for LLNL buildings

Serving as the primary contact point for the Laboratory Emergency Duty Officer.

The occurrence reporting function of the division provides the Laboratory with guidance and coordination of the DOE-mandated occurrence reporting system. As part of this function, the division develops the Occurrence Reporting Implementation Plan, coordinates the submission of all LLNL occurrences, and provides Laboratory directorates with guidance on occurrence reporting issues.

Environment, Safety, and Health Teams

The four ES&H teams are individual divisions in the Hazards Control Department that provide environmental, safety, and health support to the various research and support organizations at LLNL. Each team has about 27 employees. The teams support specific program areas and include both technicians and professionals from different fields of safety and health. In addition, specialists from the Environmental Protection and Health Services Departments are assigned to the teams.

The mission of the four ES&H teams is to provide both high quality and timely environmental, safety, and health support to Laboratory programs and organizations in alignment with not only their Mission, Vision, and Purpose, but also with the Mission, Vision, Purpose, Core Values and Beliefs of the Hazards Control Department. The ES&H teams achieve their respective missions by working closely with LLNL programs to foster an atmosphere of cooperation in accident prevention and problem solving to achieve this goal.

As part of their daily routine, the staff of the teams advise, monitor, and evaluate programmatic activities; provide emergency response services; and assist in the training of program personnel. The teams also

Figure 11. ES&H Teams provide integrated safety and environmental support to line organizations.
perform audits and inspections, conduct incident analyses and accident investigations, restrict operations that are imminent hazards, and inform top program management of ES&H issues when appropriate. In addition, ES&H Team 1 manages the off-shift Health and Safety support program that provides night and weekend ES&H coverage to LLNL.

Field Deployed Personnel Resources by ES&H Team

Table 9 shows the FTE support on the four ES&H Teams at the end of 1996 as compared with that at the end of 1995. The number or fraction indicated represents a person actively employed as opposed to an authorized position, which may or may not be filled.

Integrated Safety Management / Work Smart Standards Project Office

This office was formed in mid-1996 as a three-person office with responsibility to implement the Work Smart Standards (WSS) process at LLNL. This office is also developing documents to describe how an integrated safety management system will be implemented at LLNL. The WSS process will inventory the work performed by the Laboratory and analyze the hazards associated with the work. A joint team of UC, LLNL, and DOE/OAK operational and technical subject matter experts will define the set of ES&H standards that will serve as the agreed-upon basis for operating the Laboratory in a safe, efficient, and cost-effective manner that provides adequate protection to personnel, the public, and the environment.

Following approval by DOE, the WSS set will replace the current list of DOE ES&H orders and directives in Appendix G of the contract between UC and DOE for the operation of LLNL.

In concert with this effort, the Laboratory will be improving its safety management system to integrate ES&H into all levels of work planning and execution so that work at the Laboratory continues to be accomplished in a manner that protects the public, Laboratory staff, and the environment.

Safety Labs Division

The Safety Labs Division had 50 employees at the end of 1996, an increase of 10 employees after incorporating the HCD Management Information Systems Team (MIST) into SLD. The Safety Labs Division provides technical support services to the Hazards Control Department and LLNL programs to assure that employees have the ability to perform their work safely.


<table>
<thead>
<tr>
<th>Assignment</th>
<th># FTEs—December 1996 /# FTEs—December 1995</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Team 1</td>
</tr>
<tr>
<td>Division Leader</td>
<td>1 / 1</td>
</tr>
<tr>
<td>Deputy Division Leader</td>
<td>1 / 1</td>
</tr>
<tr>
<td>Administrative</td>
<td>1.5 / 1.5</td>
</tr>
<tr>
<td>Lead Technician</td>
<td>1 / 1</td>
</tr>
<tr>
<td>Special Support Technicians(a)</td>
<td>1 / 0</td>
</tr>
<tr>
<td>Field H&amp;S Technicians</td>
<td>12 / 11</td>
</tr>
<tr>
<td>Industrial Safety Engineers</td>
<td>0 / 0</td>
</tr>
<tr>
<td>Industrial Hygienists</td>
<td>1 / 1</td>
</tr>
<tr>
<td>Health Physicists</td>
<td>2 / 2</td>
</tr>
<tr>
<td>Fire Protection Engineers</td>
<td>1 / 1</td>
</tr>
<tr>
<td>Environmental Analysts</td>
<td>2 / 2</td>
</tr>
<tr>
<td>Explosive Safety Engineers</td>
<td>3 / 3</td>
</tr>
<tr>
<td>Total</td>
<td>26.5 / 24.5</td>
</tr>
</tbody>
</table>

\(a\) Individual is dedicated to specific work (e.g., asbestos monitoring, design review).

\(b\) AR = As Required.
The ten, self-directed work teams in SLD are organized in alignment with the services they provide; these teams form the administrative structure within SLD:

- **Analytical Lab Team**—provides routine and rush chemical analyses for a wide variety of samples submitted by HCD H&S technicians, disciplines, and program personnel; work includes sample preparation for some analyses performed by the Radiation Measurements Lab Team.

- **Radiation Measurements Lab Team**—provides routine and rush gas proportional and liquid scintillation measurements on samples submitted by HCD H&S Technicians, disciplines, and program personnel.

- **Bioassay Team**—provides collection, processing, and analyses of samples from people who require routine or rush bioassay to determine their dose from potential exposure to radionuclides.

- **Whole Body Counting Team**—provides all the services needed for people who require routine or rush in-vivo measurements to determine their dose from potential exposure to radionuclides. They also perform alpha and gamma spectroscopy measurements.

- **Personnel Dosimetry Team**—provides all the services for external dosimetry (using thermoluminescent dosimetry and CR-39 dosimetry). This includes dosimeter issuance, processing, data processing and retention, dose investigation, and reporting. All employees at LLNL wear dosimeters.

- **Management Information Systems Team**—provides both computer hardware and software support to HCD employees and projects, including desktop support, specialty databases and applications, such as those that track training records, sample records, injury and illness statistics.

- **Respiratory Services Team**—provides all the services needed for employees who must wear air-purifying respiratory protection to perform their work safely. This includes training and testing of respirator users, respirator cleaning, testing, and issuance, and record keeping.

- **Industrial Hygiene Instrument Lab Team (IHIL)**—provides maintenance, calibration, and issuance of all industrial hygiene instruments and equipment used by Hazards Control and LLNL programs, including emergency response instrumentation. They also test HEPA filter systems throughout LLNL facilities to assure that they are providing the needed protection to meet air emission requirements.

- **Calibration and Standards Lab (CSL)**—provides maintenance and calibration for most portable radiation measurement instruments used by Hazards Control and LLNL programs, including emergency response instrumentation. **Note:** In late 1996, IHIL and CSL were combined to integrate all the instrument calibration services into one team.

- **Administration and Management Team**—provides support to the ten SLD teams to assist them in their efforts to provide services to HCD.

### Special Projects Division

The Special Projects Division, which has 49 employees, is a multidisciplinary team of scientists and technicians who provide solutions to current and anticipated health, safety, and environmental problems at LLNL and to external customers inside and outside the DOE community. This team maintains specialized expertise and facilities to identify problems, define and develop solutions, and provide transitional support for the implementation of new technologies. The division receives no direct overhead funds from LLNL, not even division staff and administrative costs. It is 100% funded by the work it does for LLNL customers and external sponsors (e.g., DOE, Nuclear Regulatory Commission).

SPD supports the Hazards Control Department and Laboratory programs at LLNL through regular interactions with ES&H Team division leaders and TSPD technical leaders. SPD serves as a technical resource for the DOE and other organizations, and participates in standards development. The division performs basic and applied research in the disciplines of fire safety, industrial hygiene, industrial safety, radiation safety, explosives safety, environmental protection, and other safety-related sciences.

### Technical Support and Policy Development Division

The Technical Support and Policy Development Division, which has 22 employees, is responsible for providing technical leadership and support to the safety and health discipline members and technicians in the Hazards Control Department. This division is responsible for coordinating the development and publication of the LLNL *Health & Safety Manual* and maintaining the electronic version of the manual. The
division also maintains the Lessons Learned Program for the Laboratory.

TSPD includes technical leaders for fire safety, industrial safety, industrial hygiene, health physics disciplines, and technicians. These technical leaders are responsible for working with the respective ES&H team members to develop and disseminate safety and health policies and guidance that are technically sound, compatible with regulations, and consistently applied across the Laboratory.

Standing Committees

The HCD standing committees were established as part of the departmental reorganization in 1993, and are made up of department personnel. These committees give HCD employees an opportunity to participate in department decisions, as well as help them develop new skills. Each committee has a liaison from the HCD management (e.g., a Division or Deputy Division Leader), who regularly briefs HCD management on committee activities. Management must approve all committee recommendations.

In 1996, a new committee, Integrated Support, was authorized by department management, bringing the total number of employee committees to four:

- **Customer Committee**—tasked with developing an ongoing mechanism of customer feedback to judge how well HCD technical support and services help customers achieve a working environment where every LLNL employee has the means, ability, and desire to work safely. A similar ongoing mechanism was developed and implemented to obtain feedback from HCD employees.

- **Rewards Committee**—tasked with developing a rewards system, performance appraisal process, and non-monetary rewards in alignment with the mission, vision, purpose, and core beliefs of HCD. This committee is composed of representatives from all job classifications in the department (e.g., Administrative, Engineer, Scientist, Technician).

- **Communication Committee**—tasked with developing efficient and effective intradepartmental communications. An example is regular publication of the *HC Bulletin*, which is also being installed on the HCD Internet Home Page.

- **Integrated Support Committee**—tasked with developing a document(s) for internal HCD use that will promote a broader appreciation and understanding among HCD staff of the various services offered by the department.