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

# Lawrence Berkeley National Laboratory

**April 2009**

Office of Environment, Safety and Health Evaluations
Office of Independent Oversight
Office of Health, Safety and Security
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HSS
Office of Health, Safety and Security

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# Abbreviations Used in This Report

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| **AHD** | *Activity Hazard Document* |
| **ALS** | *Advanced Light Source* |
| **BSO** | *Berkeley Site Office* |
| **CAIRS** | *Computerized Accident/Incident Reporting System* |
| **CATS** | *Corrective Action Tracking System* |
| **CFR** | *Code of Federal Regulations* |
| **CHSP** | *Chemical Hygiene and Safety Plan* |
| **CMS** | *Chemical Management System* |
| **CSD** | *LBNL Chemical Sciences Division* |
| **DOE** | *U.S. Department of Energy* |
| **EH&S** | *LBNL Environment, Health, and Safety* |
| **ES&H** | *Environment, Safety, and Health* |
| **HSS** | *DOE Office of Health, Safety and Security* |
| **ISC** | *Integrated Support Center* |
| **ISM** | *Integrated Safety Management* |
| **JHA** | *Job Hazard Analysis* |
| **LBNL** | *Lawrence Berkeley National Laboratory* |
| **LSD** | *LBNL Life Sciences Division* |
| **NFPA** | *National Fire Protection Association* |
| **OSHA** | *Occupational Safety and Health Administration* |
| **PBD** | *LBNL Physical Biosciences Division* |
| **PPE** | *Personal Protective Equipment* |
| **RWA** | *Radiological Work Authorization* |
| **SC** | *Office of Science* |
| **TAP** | *Technical Assurance Program* |

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# 1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight, within the Office of Health, Safety and Security (HSS), inspected environment, safety, and health (ES&H) programs at the DOE Lawrence Berkeley National Laboratory (LBNL) during January through February 2009. The inspection was performed by the Office of Independent Oversight's Office of Environment, Safety and Health Evaluations.

At DOE Headquarters, the DOE Office of Science (SC) has primary line management responsibility for LBNL. Accordingly, SC has overall Headquarters responsibility for programmatic direction, funding of activities, and ES&H at the site. At the site level, line management responsibility for LBNL falls under the Manager of the Berkeley Site Office (BSO). LBNL is managed by the University of California under contract to DOE.

LBNL's primary mission involves research and development in a wide range of areas, including sustainable energy, biological systems, advanced materials, physics, earth and climate science, and supercomputing. To accomplish this mission, LBNL operates various scientific facilities, including various user facilities such as the Advanced Light Source (ALS). Potential hazards that need to be effectively controlled at LBNL include exposure to radiation, radiological contamination, hazardous chemicals, laser operations, and various physical hazards associated with facility operations (e.g., high-voltage electrical equipment, working at elevated heights).

The purpose of this Independent Oversight inspection was to assess the effectiveness of ES&H programs at LBNL under the direction of BSO and SC. The Independent Oversight team evaluated a sample of activities at LBNL that provide perspectives on the safety of current work activities at LBNL, including:

- Implementation of the core functions of integrated safety management (ISM) for selected work activities at LBNL, focusing on work planning and control systems at the activity level. The Independent Oversight inspection selectively evaluated research and development and facility operations activities at the ALS, the Chemical Sciences Division (CSD), the Physical Biosciences

**Aerial View of LBNL**

Division (PBD), and the Life Sciences Division (LSD), as well as construction and maintenance activities performed by the Facilities Division.

- BSO's and LBNL's effectiveness in managing and implementing selected aspects of the ES&H program that the Office of Independent Oversight has identified as focus areas, including chemical management, waste management, injury and illness reporting, and communication of workers' rights in accordance with the parameters of 10 CFR 851, *Worker Safety and Health Program*. Although these topics are not individually rated, the results of focus area reviews are integrated with or considered in the evaluation of other ISM elements. The HSS Office of Corporate Safety Analysis supported the inspection by performing a quality review of occupational injury and illness recordkeeping and reporting.

- Selected aspects of BSO and LBNL feedback and continuous improvement systems. Specifically, the Independent Oversight team focused on BSO oversight of LBNL ES&H programs and LBNL's feedback and improvement processes as applied to the systems and processes reviewed by the Independent Oversight team on this inspection. The review of feedback and improvement systems also constitutes Independent Oversight's evaluation of the effectiveness of implementation of DOE Order 226.1A, *Implementation of DOE Oversight Policy*, which is a long-term Independent Oversight focus area.

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

Appendix B presents the findings identified during this Independent Oversight inspection. The findings are also referenced in the applicable portions of Sections 3 and 4 of this report. In most cases, the findings listed in Appendix B were derived from multiple individual deficiencies that are described in the detailed results provided to DOE and contractor management in a separate document.

In accordance with DOE Order 470.2B, *Independent Oversight and Performance Assurance Program*, SC must develop a corrective action plan to address each of the findings identified in Appendix B, including the associated individual deficiencies, and provide appropriate causal analyses, corrective actions, and recurrence controls for each finding. The weaknesses set forth in Section 3 provide a management-level summary of the findings; these weaknesses do not need to be addressed separately in the corrective action plan because the findings encompass the scope of the weaknesses.

# 2 Positive Attributes

Positive attributes were identified in several ES&H programs, particularly in establishing a framework for safety improvement. Many of the positive aspects are the result of recent BSO and LBNL management initiatives.

**BSO and LBNL senior management have been proactively working to improve safety management at LBNL.** In the past two years, senior BSO and LBNL managers have recognized that LBNL needed to improve the LBNL safety management processes and have taken a number of actions to achieve the needed improvements. Specifically, LBNL senior management has directed the development of a number of major improvement initiatives, such as the effort to develop and implement a job hazard analysis (JHA) and work authorization process across the site, a program to reduce chemical hazards, initiatives to strengthen control of construction subcontractors, efforts to improve the contractor assurance system, and a systematic program to reduce ergonomic injuries. Personnel from the University of California's Office of the President were also engaged in safety at LBNL and were represented throughout this Independent Oversight inspection. BSO has supported the LBNL initiatives and has taken proactive actions to provide contractual incentives to LBNL to make the needed improvements and to enhance its oversight processes and management systems. For example, BSO soon will be implementing its Workspace system, which creates a centralized portal for BSO employees to track deliverables and collect and distribute information from various sources in one location (e.g., tracking systems, contracts deliverables matrix, and lessons learned). Although many of the initiatives are in their early stages of implementation and much work remains to further improve the new processes, the recent progress is notable. Further, lower tiers of management, scientific staff, and workers demonstrated their support for safety and recognize the need to make further improvements in safety management processes, indicating that BSO and LBNL senior management

**Research Equipment used at Life Science Division**

has had considerable success in communicating their expectations for effective safety management processes and continuous improvement in ES&H programs.

**The combination of the experiment review process, user training, beam line scientist oversight of user activities, and extensive use of engineered controls provides an integrated system of hazard analysis and control for outside users at ALS.** Experiment safety sheets documenting the experiment review are comprehensive and indicate adequate involvement of subject matter experts and beam line scientists in the review process. Online training is comprehensive and appropriate. Beam line scientists are readily available to assist users. LBNL scientists operate in a manner that minimizes the need for user interface with the beam lines, thus reducing the potential for exposure to unfamiliar hazards. Finally, the suite of engineering controls for hazards is extensive, including interlocked access controls to protect against radiation and laser hazards, and equipment interlocks (such as door interlocks and switched floor pads) to protect against mechanical movement hazards.

**LBNL construction managers and safety professionals provide effective oversight of construction activities.** The LBNL construction managers understand that they are line managers responsible for safety and demonstrate a high degree of attention to safety. Safety professionals visit construction sites frequently and provide feedback and support on conditions needing improvement. The effective construction oversight contributes to effective implementation of safety provisions at construction jobsites: site access is well controlled, workers are properly trained, training records are maintained at each jobsite, safety is emphasized during weekly and daily planning meetings, and workers understand that they are expected to work safely.

**Some elements of the contractor assurance system are innovative and have the potential to be highly effective.** The LBNL technical assurance program (TAP) has the potential to be a highly effective tool for subject matter experts to assess the adequacy of safety programs and implementation. Although in its early stages of implementation, the TAP concept – including the comprehensive approach to evaluating compliance, performance, and program adequacy defined in the program manual; the formal assessment plans; and the reporting and trending requirements – constitute an effective self-assessment program element. The program is founded on each subject matter expert developing formal assessment plans that include descriptions of the almost 50 program subject areas, including hazards and controls, identification of regulatory mandated assessment activities, summaries of prior internal and external assessments, open issues and corrective action tracking system status, events and lessons learned affecting the functional area, and the scope and schedule for inspections and assessment activities, including documentation reviews and field work. A guidance committee of subject matter peers meets regularly to share ideas and observations on trends and suggestions for improving the process. A steering committee composed of managers and group representatives from the LBNL Environment, Health, and Safety (EH&S) Division, a representative from the Office of Contract Assurance, and the chairman of the Division Safety Coordinator Committee review TAP reports, support subject matter experts, and make recommendations for improving the program. LBNL has also established an innovative and effective means to communicate lessons learned to the persons who can or need to apply those lessons (i.e., a software linkage between the lessons-learned database and the JHA software used to email lessons learned to a targeted audience of JHA signatories for specific topical areas).

# 3 Weaknesses

Although some aspects of ES&H are effective, there are weaknesses in LBNL ES&H programs in a number of areas, such as the JHA process, requirements management, and feedback and improvement processes. Some of the programs have been established or improved recently, but are not yet mature or fully effective.

**The LBNL JHA process design and implementation does not sufficiently ensure that all hazards at the activity level are systematically identified, analyzed, and controlled.** Although individual divisions have expended significant effort in developing and implementing the JHA process over the last year, process implementation has not been sufficiently effective in addressing an integrated hazard assessment at the job activity level. Most efforts to date have focused on putting JHAs in place, but JHA effectiveness has been limited because the guidance on actual content was not sufficient and the quality of JHAs was not adequately monitored and reviewed. Further, individual divisions are moving forward with solutions that may or may not be compatible with the intent of the institutional process, in large part because few criteria or milestones related to the quality of the JHAs have been established, and no system for real-time assistance or quality feedback has been implemented. Consequently, participants have received minimal real-time guidance or feedback on the quality of their efforts. For example, expectations for tailoring task lists were not well defined or communicated. In addition, the JHA template at the task level provides hazard-based tasks that, without tailoring to specific jobs, do not adequately define specific job tasks. For example, the database generates generic tasks, such as working with cryogens or working with chemicals, that do not address specific activity-level tasks, such as operating a specific liquid nitrogen system or synthesizing particular chemicals. In most JHAs that were reviewed, the task lists contained the generic task directly from the JHA template and did not provide such tailoring; consequently, the work was not sufficiently defined to be able to meet the 10 CFR 851 requirement to implement procedures that "perform routine job activity level hazard analyses." The weaknesses in the institutional program contributed to deficiencies in application of the ISM core function in all six of the organization/activities reviewed by Independent Oversight during this inspection. (See Finding #C-1.)

**A Construction Project at LBNL**

ALS Beamline Ring

**Processes for managing requirements are not sufficient to ensure that all appropriate safety requirements are properly identified and communicated to the working level.** LBNL processes and procedures do not always distinguish between requirements and guidance and contain redundant and conflicting institutional documents, documents for which the authority is not well defined, and some confusing and inconsistent format in instructions to workers. The EH&S Manual does not sufficiently detail roles and responsibilities and lacks sufficient specificity regarding requirements and guidance for many functional areas. There are numerous inconsistencies and internal conflicts in LBNL requirements documents, including documents that are referenced but that do not exist or that are not issued as requirements documents. Requirements regarding the radiation protection program, exposure monitoring, chemical fume hoods, and some aspects of electrical safety are not adequately specified, leading to performance deficiencies and safety vulnerabilities. LBNL has not sufficiently detailed safety and ISM requirements in implementing documents that effectively communicate management expectations and DOE and regulatory requirements down to the task level. Some of the requirements management deficiencies are attributed to the fact that LBNL has not adequately established a defined and structured hierarchy of documents (e.g., policies, plans, procedures, instructions, and manuals), an associated identification/number scheme, and configuration control mechanisms for effectively communicating management expectations and requirements. Deficiencies in ISM documentation were identified during a 2006 LBNL ISM evaluation, but corrective actions have not been sufficient. (See Findings #C-1, #C-2, #C-3, #C-4, #C-5, and #D-2.)

**LBNL assurance processes and activities are not fully effective in identifying, evaluating, and addressing safety program and performance deficiencies.** These weaknesses and deficiencies are evident in the performance of assessments and in the investigation and management of issues, including injuries and illnesses, employee concerns, and operational events. Line and support organizations have not fully taken ownership of assurance systems, and personnel have not been held accountable for performance deficiencies and non-compliance with requirements. The focus of assessments has been on material conditions rather than people, processes, and performance, and on quantitative measures rather than qualitative evaluation. Incidents, events, and safety process and performance issues are often not sufficiently analyzed for causes, extent of condition, and institutional and ISM considerations to ensure identification and implementation of effective recurrence controls. (See Findings #D-1, #D-2, #D-3, and #D-4.)

# 4 Results

The following sections provide a summary assessment of the BSO and LBNL activities that the Independent Oversight team evaluated during this inspection.

## 4.1 Work Planning and Control

This 2009 Independent Oversight inspection determined that LBNL has made significant progress in improving its ISM program in the past two years, as a result of initiatives driven by BSO and LBNL senior management. As noted in Section 2, the ISM program has been improved through such efforts as the implementation of the JHA and work authorization processes. Some LBNL divisions, such as ALS, have implemented effective programs for identifying, analyzing, and controlling applicable facility and most workplace hazards. However, many of the initiatives are in their early stages of implementation and are not yet mature and fully effective. In addition to the institutional weaknesses in the JHA process and requirements management discussed in Section 3, Independent Oversight identified institutional weaknesses in the LBNL non-radiological exposure assessment (which is not sufficiently defined or implemented) and the radiation protection program (e.g., insufficient radiological controls). These institutional weaknesses impact some or all organizations, facilities, and activities at LBNL. As discussed below for each of the six organizations/activities that were reviewed by Independent Oversight, improvements have been made and some aspects of work planning and control are effective, but there are deficiencies in the identification, analysis, and implementation of safety controls in each of the reviewed organizations. While further improvement is needed in a number of areas, LBNL management recognizes the need to continue and refine its recent improvement initiatives and has established an ISM Improvement Project Plan that provides a good baseline for consolidating needed improvement actions.

### Advanced Light Source

The ALS user facility generates synchrotron radiation (x-rays) that is used to investigate various forms of matter and is operated by the ALS Division of LBNL. During the inspection, the Independent Oversight team observed several work activities including outage work, accelerator operations activities, experimental activities at the beam lines, chemical laboratory work, and machine shop work. The Independent Oversight team also reviewed the ALS experiment review process, including implementation of the experiment safety sheet process; walked down chemical laboratories, shops, material storage areas, and waste storage areas; and participated in ALS user training.

In most cases, ALS work is well defined through experiment proposals, JHAs, activity hazard documents (AHDs), work permits, and other work documents. For example, the scopes of work for experimental activities

are extensively defined through experiment proposals that describe the experiments, materials, and overall experimental approach in sufficient detail to permit effective hazard identification and analysis. Similar to other divisions, ALS personal JHAs do not describe the scope of work for some jobs in sufficient detail to be able to recognize all hazards. However, the effect of this deficiency at ALS is limited because of the extensive use of other work control processes for complex or higher-risk activities. (See Finding #C-1.)

ALS experimental and operational hazards, along with hazards potentially introduced by facility modifications and activities involving multiple hazards, are generally well analyzed through several mechanisms, such as a proposal review process, work permits, and AHDs. For example, modifications to change the method of ALS operation received extensive hazards review, including analysis of failure modes and potential accidents, and detailed calculations of consequences and the potential accident scenarios were appropriated evaluated. Similar to other divisions, ALS has not performed baseline hazard surveys of all work areas as required by 10 CFR 851. However, although ALS has not evaluated a few hazards associated with paint chips and lead solder, most hazards at ALS are adequately analyzed. (See Findings #C-1 and #C-2.)

In most cases where hazards have been adequately identified and analyzed, ALS has established appropriate engineering and administrative controls commensurate with the hazards for which these controls are intended. ALS makes extensive and effective use of engineering controls, such as shielding and interlock systems, to mitigate the potential for exposure to high-risk hazards such as radiation, high voltage, and laser light. ALS Division management and staff displayed their commitment to teamwork and safety in the development and implementation of hazard controls, and ALS staff personnel are experienced, well trained, and knowledgeable of ALS systems and hazard controls. Although hazard controls are effective in most cases, the Independent Oversight team observed a few instances where they were not properly implemented (e.g., a boom attachment not approved by the forklift manufacturer as required). In these cases, facility management promptly initiated actions to address the deficiencies.

At ALS, formal processes are in place to verify readiness, and with only minor exceptions, work is performed in accordance with established controls. Management has established expectations to operate the ALS in accordance with DOE Order 5480.19, *Conduct of Operations*, provisions even though the requirements section of this order is not in the LBNL contract. A sampling of operations activities indicated rigorous accelerator field and control room conduct of operations in accordance with those guidelines.

Overall, ALS has adequately implemented the core functions of ISM. Most work at ALS consists of experimental and facility/equipment operations; hazards for these activities are effectively identified, analyzed, and controlled through various ALS-specific processes, such as AHDs and proposal reviews. The institutional deficiencies in LBNL JHA processes (e.g., not describing the scope of work for some jobs in sufficient detail to be able to recognize all hazards) are also evident at ALS, but their effect is limited because of the extensive use of other work control processes for complex or higher-risk activities. ALS took prompt action to correct the deficiencies specific to ALS, but additional LBNL management attention is needed to improve the institutional processes that contribute to these deficiencies.

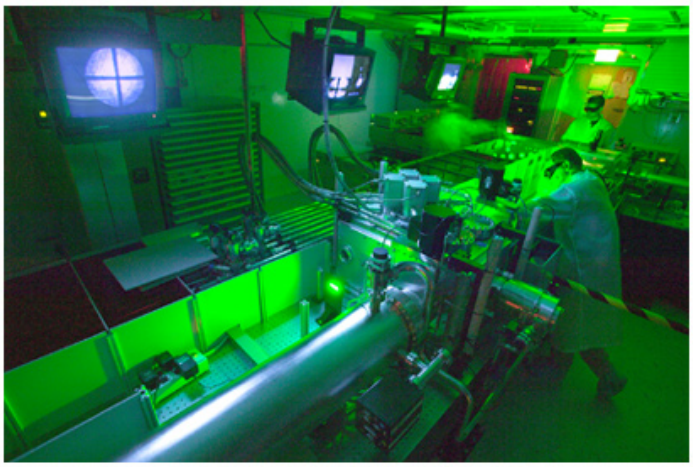
## Physical Biosciences Division

The mission of the PBD is to integrate techniques and concepts of the physical and engineering sciences into the investigation of biological systems, and to use this information to solve some of society's greatest challenges in the areas of medical diagnostics, renewable energy, and biofuels research. The Independent Oversight team observed varied research experiments being performed within these facilities in such areas as molecular and structural systems biology and fuels synthesis research.

Work scopes at PBD are well defined for some research activities or experiments but not for others. Some research experiments are repetitive in nature or are governed by well-documented protocols, research proposals, or technical publications; work descriptions for those experiments are often sufficient to characterize the hazards, particularly for those tasks that are also accompanied by safe work authorization documents, such as AHDs, radiological work authorizations (RWAs), or biological use authorizations. However, for other types of research activities (e.g., research experiments where the work descriptions are not clearly documented in proposals or protocols), the work scopes are not well documented and are not always sufficient to facilitate identification of hazards, particularly for personnel who have less experience or knowledge, and/or who are only incidentally involved in the research activity. Individual JHAs, as applied to PBD research, typically do not provide sufficient detail about research work at the experiment level to allow identification of experiment-level hazards and controls. (See Finding #C-1.)

Most hazards within PBD have been identified and informally analyzed. Some of the higher-risk hazards, such as acute toxic gases, lasers, work with radioactive material, and the use of biological agents, have been identified and analyzed, and the results of such analysis have been documented in safe work authorization documents. Ergonomic hazards associated with working in PBD offices and laboratories (such as the Joint BioEnergy Institute Robotic Lab) have been systematically identified, analyzed, and documented. In addition, the PBD research staff are knowledgeable of the hazards associated with their research and have documented in their individual JHAs the general classes of hazards to which they may be exposed. However, in a few cases, hazard classes were missed from a researcher's individual JHA (robotics, ultraviolet, and cryogens). But at the research experiment level, hazards associated with a particular research experiment or research apparatus are typically not documented in JHAs, research protocols, or elsewhere, although some hazards may be anecdotally noted in a researcher's lab notebook. In addition, since the LBNL exposure assessment program is not fully developed, much work remains in PBD laboratories with respect to defining and performing exposure assessments and integrating the resulting hazard controls into JHAs and other work documents. (See Findings #C-1, #C-2, and #C-4.)

Throughout the PBD laboratories, effective engineering and administrative controls have been developed and implemented. Institutional training programs are extensive, and most research staff members are current with respect to their training requirements. Mentoring and on-the-job training have been effective in communicating hazards and controls, but such programs are not well defined. However, deficiencies in controls were identified in a number of areas, including hazard labeling on secondary chemical containers, chemical bar coding, radiological controls, chemical fume hoods, and documenting controls at the research activity level. Many of the deficient controls identified at PBD are attributable to weaknesses in institutional programs, such as radiation protection and JHAs, and to deficiencies in identifying, communicating, and implementing applicable requirements. (See Findings #C-1, #C-3, and #C-4.)



**A Laser Lab at LBNL**

In general, where controls have been established and well documented, the PBD research staff is conscientious in following those controls. For example, the controls documented in safe work authorization documents were followed in all observed

research activities. However, few controls are documented for activities at the research experiment level because of the weaknesses discussed above.

Overall, a number of hazards have been adequately identified, analyzed, and controlled, particularly for potentially hazardous activities governed by safe work authorization documents. However, for other types of work, weaknesses in institutional processes exist and their application at PBD is not always rigorous or documented, resulting in a number of hazards that are not adequately controlled and safety requirements that are not met. The PBD work control process is informal and relies extensively on experience, training, and expertise, but it often lacks sufficient documentation at the experiment level to ensure adequate and consistent communication of hazards and expected controls to all who are involved in the research activity, including research scientists with less knowledge and/or experience in the experimental area, PBD management, BSO, EH&S staff, and students. As a result, opportunities for reducing risk and identifying and communicating hazards and controls may be missed.

## Chemical Sciences Division

The CSD has three groups that perform research at the LBNL site: the Chemical Physics; Atomic, Molecular and Optical Sciences; and Actinide Chemistry groups. CSD performs experimental research (principally related to work involving the use of Class 3b and Class 4 lasers), radiochemical operations, and other non-radiological chemistry operations.

For most CSD work, safe work authorizations (AHDs and RWAs) define the work scopes in sufficient detail to identify principal hazards associated with laser operations and radiological experiments. However, these activities include other hazards not covered by the safe work authorizations, and some activities, such as laboratory-scale research, are governed only by JHAs. Most of the individual JHAs that were reviewed did not contain sufficiently detailed statements of work to be able to determine all task specific hazards and controls. LBNL recognizes this weakness and has taken action to improve the process for developing JHAs, but few JHAs have been revised to date. (See Finding #C-1.)

Analyses of specific laser hazards and radiological hazards associated with AHDs and RWAs are generally effective and sufficient to enable proper specification of controls. However, the Radiation Protection Group lacks sufficient institutional technical bases in the area of radiological air sampling and in establishment of hazard guide values and risk categories for RWAs as needed to adequately analyze the hazards and ensure proper development of controls. In addition, some activities, such as work not requiring a safe work authorization and/or containing hazards not specifically addressed by the safe work authorization, have not been sufficiently defined to identify and effectively analyze all applicable hazards associated with work activities. As a result, hazards were not always identified or sufficiently analyzed for such activities as maintenance and servicing of lasers, biological materials use, and hazardous chemical use. (See Findings #C-1, #C-2, #C-3, #C-4, and #D-2.)

Some engineering and administrative controls within CSD are robust, including access controls, interlocks, radiological inventories, and use of containments. However, individual JHAs supporting work activities are not sufficiently tailored to discrete work activities and do not adequately convey specific controls necessary to mitigate all activity-level hazards. In some cases, controls simply consist of instructions to perform a hazard analysis. In other cases, details on required controls are overly generic, such as "use appropriate PPE [personal protective equipment]," and therefore inappropriately require the worker to determine the controls at the time of work. For radiological work, institutional requirements governing preparation of RWAs are not well defined and have resulted in incomplete specification of needed radiological controls in written RWAs. In addition, institutional weaknesses in specification of radiological control requirements have contributed

to fundamental deficiencies in ensuring proper implementation of radiological requirements in the areas of contamination control, radiological surveys and recordkeeping, radiological posting and boundary control, and training, as required by 10 CFR 835. (See Findings #C-1, #C-3, and #C-4.)

Most work activities that were observed were performed in accordance with required controls. Workers and researchers were generally diligent about following prescribed controls when these controls were clearly conveyed through work control processes and/or training.

Overall, hazards for laser experiment operations and certain other experimental activities covered by specific hazards analysis processes (i.e., AHDs) are adequately identified and controlled. However, there are institutional weaknesses in some aspects of work control systems (e.g., JHAs) and radiological protection requirements, as well as excessive use of expert-based safety protocols, that result in some hazards that are not adequately controlled and some safety requirements that are not adequately implemented.

## Life Sciences Division

The mission of the LSD is to contribute to strategic laboratory and national efforts in key human health issues. LSD performs research in such areas as bioenergy, structural biology, cancer damage responses, genome dynamics, and radiotracer development and technology.

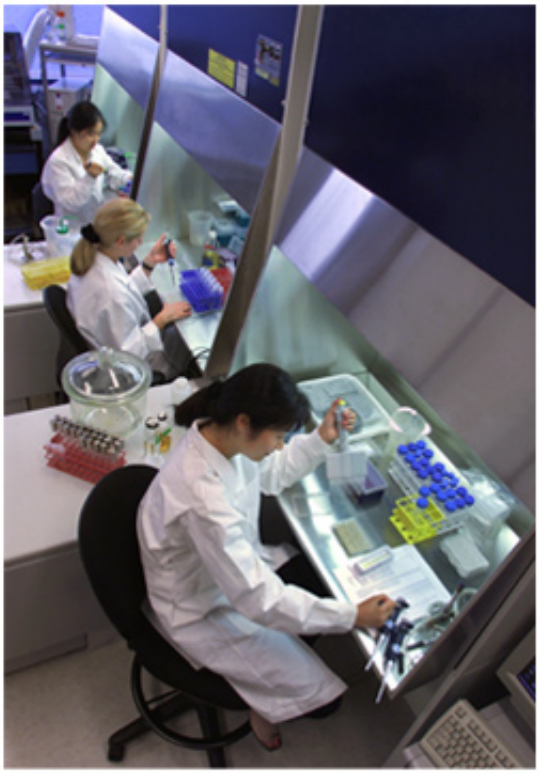
Work at LSD is defined in a manner typical of research settings and includes a variety of documents, beginning with some type of grant or research proposal. However, as with other LBNL divisions, these mechanisms have not been sufficiently implemented to ensure adequate work scope definition for some research work and activity-level tasks. Currently at LSD, some JHAs have a comprehensive definition of work scope and include work at the activity level, but LSD management recognizes that some JHAs do not have sufficient detail to define work scopes. (See Finding #C-1.)

Many activities at LSD are laboratory-scale experiments that use only small quantities of hazardous materials, and LSD has analyzed some of the higher-risk activities. Observations and discussions with LSD workers indicated that principal investigators and staff were aware of most hazards at the activity level. Although improvements are ongoing, there are deficiencies in some aspects of hazard analysis processes at LSD that are not addressed in institutional documents and that are similar to those noted at other LBNL divisions (e.g., insufficient thresholds or criteria for safety/industrial hygiene evaluations). As a result, some common task activities and hazards, such as hydrofluoric acid, dust from metal oxide formulation, lead, sharps, liquid nitrogen, and noise, have not been sufficiently analyzed. (See Finding #C-1.)

Engineering and administrative controls are in place for many hazards. Many potentially hazardous work activities are performed in chemical hoods, interlocks are installed in hazardous equipment (such as x-ray apparatus), postings are in place, and procedures and protocols are being modified to include hazard and control information. LSD has published a safety plan that effectively outlines the roles and responsibilities of managers, principal investigators, safety coordinators, committee members, researchers, students, and guests. In several areas, LSD management has developed and implemented effective controls for LSD laboratories (e.g., enhanced safety eyewear and a detailed biosafety, security, and incident response plan). LSD management recognizes that the current JHA process is somewhat difficult to use and is developing a better process for capturing and documenting task-specific hazards and controls. Although principal investigators and work leads mentor and train employees, students, and guests before starting task-specific activities, the process is still mostly informal and documented by a signature, without any checklist or training content. (See Finding #C-4.)

Based on work observations and discussions, laboratory personnel (e.g., principal investigators, researchers, students, and technicians) have a strong awareness of the hazards and controls necessary to work safely in LBNL labs. Where controls are specified in work documents or postings, workers followed them for work reviewed by the Independent Oversight team. LSD management has recently devoted extensive effort to improving the safety of work practices, including two formal safety stand-downs to focus attention on safety practices.

Overall, LSD has devoted significant attention to improving ISM processes, including JHAs and work authorization. These efforts have resulted in significant recent improvements in work control processes as applied to LSD activities. However, some aspects of the LSD work control processes, particularly the hazard analysis processes and on-the-job training, need further improvement.



Life Science Research Activities

## Maintenance and Fabrication

Most work definitions for maintenance and fabrication activities are brief. Therefore, LBNL relies heavily on verbal communication to define the work so that activities and potential hazards can be identified. In some cases, written work definitions alone were not described in sufficient detail to effectively analyze and control hazards. The work control process relies on the broad work group task description contained within each individual worker's JHA without benefit of further task-specific breakdown. Supervision or EH&S Division subject matter experts' input is limited for some work activities. (See Finding #C-1.)

Some hazard analyses are performed for maintenance and fabrication activities in accordance with the JHAs. However, the JHA process has gaps where hazards can be missed. For activities that use work-group JHAs rather than task-specific JHAs, hazard analysis processes are not always effective because they do not have sufficient LBNL EH&S subject matter experts' input and rely too much on the worker's knowledge in areas where the workers may not have sufficient training or information to make conservative decisions. This condition has resulted in some hazards (e.g., noise, lead, magnetic fields, hazardous cleaning fluids, hexavalent chromium) not being identified and controlled. In addition, exposure assessments have not been performed for many maintenance and fabrication activities. (See Findings #C-1 and #C-2.)

Many hazards encountered during maintenance and fabrication work are adequately controlled through engineered controls, administrative controls, and/or PPE. However, the use of broad work-group JHAs has resulted in a system where workers are often expected to choose the controls they believe are applicable, even though the workers may not have the requisite expertise to select the proper controls. Although workers are directed to seek EH&S subject matter expert assistance or refer to various EH&S Manual chapters to establish controls, there are instances where the workers may not be sufficiently cognizant of the hazards and controls to recognize that they need assistance or additional information. As a result of weaknesses in the JHA process and implementation, several deficiencies were identified in lockout/tagout during electrical work, proper PPE was not always specified, and some controls referenced in LBNL division-level procedures and/or JHAs had not been developed or implemented as listed on the work authorization (JHA and/or work

order) before conducting the work (e.g., training and controls for sharps, lead, and electrical penetrations). (See Findings #C-1 and #C-5.)

A number of work evolutions observed by Independent Oversight were performed in accordance with established controls. Work is authorized only after an approved work order is issued to craft workers by the line supervisor. With some exceptions, workers demonstrated a good understanding of EH&S requirements. In most cases, workers attempted to follow controls when controls were clearly established. Although many activities are performed without incident, work control as currently implemented within the Facilities and Engineering Divisions relies heavily on the individual workers' knowledge at the time of work, rather than written instructions that supplement individual knowledge and skills. As a result, some workers were either unaware of or confused with regard to some hazard controls or did not follow postings or safety requirements in such areas as fall protection, ladder safety, hearing protection, machine safety, and welding. (See Finding #C-1.)

Overall, maintenance and fabrication activities, like other activities at LBNL, have improved as a result of management attention and development of institutional processes, such as JHAs and work authorization. Many observed activities were performed with a high regard for safety, and workers had a good understanding of most hazards and demonstrated a willingness to follow controls, when controls were clearly specified. However, the new institutional processes are in their early stages of implementation and are not yet fully effective or mature, resulting in a number of instances where hazards were not sufficiently analyzed, controlled, understood, or followed during maintenance and fabrication work.

## Construction

Construction work at LBNL is managed by the Facilities Division. Most of this work, including essentially all of the work on large capital projects and some on small projects, is performed by subcontractors. LBNL employees perform some of the small projects using LBNL processes, such as JHAs.

LBNL has established appropriate requirements, guidance, and management controls to ensure that the construction work performed by subcontractors is defined in sufficient detail to support effective identification of hazards and controls. LBNL has established work control processes that apply specifically to subcontracted work and has devoted significant attention to refining those processes and ensuring their effectiveness. However, for work performed by LBNL employees, work descriptions are often limited to brief statements on work orders that do not define tasks with sufficient specificity to support hazard analysis, and task-based JHAs are typically not prepared. (See Finding #C-1.)

LBNL has developed and implemented a number of appropriate mechanisms for identification and analysis of hazards. Collectively, these mechanisms have been used effectively to identify, analyze, and inform workers of the hazards associated with most construction activities. Most hazards are adequately analyzed and are identified on work control documents for work performed by subcontractors. However, for work performed by LBNL employees, the JHA process does not ensure full compliance with hazard analysis requirements for construction specified in 10 CFR 851. (See Finding #C-1.)

Many aspects of hazard controls are effective. Implementation of work control processes has been effective for subcontracted construction work. LBNL has established a comprehensive set of safety requirements, and with few exceptions, these requirements have been effectively communicated to construction subcontractors and LBNL employees who perform construction work. Facility Division construction managers maintain effective control over construction activities, and safety professionals from the EH&S Division visit each construction site daily to provide support and assess performance. Much of the construction work performed

by LBNL employees is within the skill of the craft and is adequately addressed in individual baseline JHAs. However, applicable controls in work control documents for construction work performed by LBNL employees are not sufficiently identified. In addition, inconsistencies between LBNL-approved subcontractor site-specific health and safety plans and the LBNL Health and Safety Plan indicate insufficient LBNL review of the subcontractor plans. (See Finding #C-1.)

When controls were adequately established, most observed work was performed within established controls by LBNL personnel and subcontractors. Daily planning meetings were particularly effective in informing workers on large construction projects of the hazards that they may encounter and ensuring readiness to perform work. Required PPE was consistently worn, permits were obtained and posted when required, requirements specified on permits were followed, and workers were properly trained. Supervisors and workers understood that they were expected to work safely and did so with few exceptions.

Overall, workers were aware of the hazards in their workplace, and most work was performed within established controls. For subcontracted construction work, which represents most of the construction work at LBNL, workplace hazards are adequately identified, analyzed, and controlled through the processes that were specifically developed to address subcontracted construction work. However, for construction work performed by LBNL employees, which represents a small portion of the construction work at LBNL, the hazards are not always sufficiently identified, analyzed, and controlled, in large part because of weaknesses in the institutional JHA process and its application to construction work activities.

## 4.2 Focus Areas

### Chemical Management

LBNL manages hazardous chemicals under requirements and guidelines established in its Chemical Hygiene and Safety Plan (CHSP). The CHSP effectively consolidates the hazard communication and laboratory standard regulatory requirements under a single program, increasing consistency and reducing confusion over which requirements apply to a specific activity. Chemical inventory is tracked through the Chemical Management System (CMS), which is capable of managing inventory data down to the individual container level. Overall, the CMS is a robust inventory tracking and analysis system that is used to support a variety of safety, industrial hygiene, environmental, and fire protection data requirements. Material safety data sheets are readily available to employees through the online search engines and, where appropriate, maintained in binders at various work locations. LBNL has also implemented a multi-faceted approach to reduce hazardous chemical risk through a concerted effort to identify and dispose of legacy chemicals and use less-hazardous chemicals.

However, further improvements are warranted in some areas. First, although CMS is used to provide the hazardous chemical list for LBNL, some types of hazardous chemicals are not included in the CMS inventory. Also, secondary containers are often labeled only with abbreviations or chemical formulas, which do not identify the chemical name or convey the appropriate warning. In addition, the potential for oxygen-deficient atmospheres associated with an unplanned cryogen release has been analyzed for some high-risk activities, but other activities and locations have not been assessed. Furthermore, in some laboratories and support facilities, some hazardous chemicals are not properly stored in accordance with the CHSP. Finally, there is no institutional process to track and verify that in-use chemicals, chemicals stored in secondary containers, and waste chemicals stored in satellite accumulation areas are below exempt amounts. (See Findings #C-2, #C-4, and #E-1.)

## Waste Management

Most aspects of LBNL's waste management program are adequately defined and implemented to manage the hazardous waste they generate. LBNL conducts most hazardous waste handling activities under a hazardous waste treatment and storage permit issued by the California Environmental Protection Agency to the Department of Energy. Offsite locations, such as Joint BioEnergy Institute and the Joint Genomics Institute, operate under separate waste generator identification numbers. The EH&S Division has developed various written procedures to communicate permit and regulatory requirements to workers.

In most cases, hazardous wastes that are generated are properly accumulated in various satellite accumulation areas and waste accumulation areas, which are operated in accordance with LBNL procedures. Hazardous waste labeling and secondary containment requirements are generally understood and followed. Once accumulated waste is requisitioned for pickup, the tracking and management of this waste are supported by a software program that is well designed for operations conducted by the Hazardous Waste Handling Facility.

However, some process and implementation deficiencies were identified. In a few instances, some waste materials that may have been hazardous, such as sandblasting grit and debris from soldering operations, were not evaluated to determine whether they were required to be managed as hazardous waste. Also, one satellite accumulation area had inappropriately accepted waste from another satellite accumulation area. Several containers of waste in satellite accumulation areas had labeling deficiencies, and several others exceeded the LBNL timeframe for remaining in a waste accumulation area. Finally, processes for pickup and transport of hazardous waste did not consider some worker safety hazards. (See Findings #C-1 and #C-4.)

## Worker Rights and Responsibilities

Communication of worker rights and responsibilities is an important element of 10 CFR 851, *Worker Safety and Health Program*. The Independent Oversight team evaluated the mechanisms used by contractors to communicate worker rights and responsibilities under 10 CFR 851 and the degree to which workers and first-line supervisors understand those rights and responsibilities. LBNL management has informed laboratory personnel about their individual rights and responsibilities, as stated in 10 CFR 851. LBNL personnel who were interviewed indicated that they would not feel intimidated by raising safety-related questions or concerns. Personnel were also aware of the formal and informal avenues available to resolve safety-related questions or concerns, including the contractor employee concerns program and the EH&S Division's email program. While personnel understood the general intent of worker rights and responsibilities under 10 CFR 851, some did not demonstrate an understanding that their rights were founded in Federal regulations, and a few construction subcontractors did not know that they had the right to have their representative accompany DOE personnel inspecting their workplace, which is a specific right stated in 10 CFR 851. However, these workers indicated that they would contact their supervisor if they had questions. Most bargaining unit officials who were interviewed indicated their belief that the trend at LBNL was positive concerning management's support of and commitment to maintaining a safe work environment and recognizing workers' involvement in that process. Several union officials expressed concerns that a previous behavior-based safety observation program had been discontinued and indicated their belief that this program needed to be resurrected and/or replaced with a comparable program. Although most comments concerning LBNL management's support of worker rights and responsibilities were positive, there were isolated concerns that some individual managers or supervisors may not be fully supportive of the worker rights and responsibilities as stated in the LBNL worker safety and health program.

### Injury and Illness Reporting

BSO has implemented suitable procedures to identify and report work-related injuries and illnesses incurred by Federal employees. Procedures are in place to ensure that occupational injuries and illnesses experienced by BSO employees are evaluated and reported, although BSO did not experience any reportable injuries in 2008.

The collection and reporting of occupational injuries and illnesses at LBNL has resulted in proper classification in most cases. Of 173 cases reviewed by the Independent Oversight team, only three were misclassified and therefore not recorded and reported as required. Employees who were interviewed by the Independent Oversight team were aware of the responsibility to promptly report all work-related injuries and illnesses. Data recorded on the 2008 Log of Work-Related Injuries and Illnesses was consistent with information reported to DOE through the Computerized Accident/Incident Reporting System (CAIRS). The Summary of Work-Related Injuries and Illnesses was properly certified and posted.

However, several performance deficiencies indicate the need for increased rigor in the documentation and reporting of injuries and illnesses. Many of the work-related occupational injury and illness investigation reports were late and omitted some necessary information. As a result, the information reported to CAIRS often lacked sufficient detail to identify hazards and corrective actions that can be shared within the DOE community.

## 4.3 Feedback and Improvement

### DOE Oversight

BSO has effectively managed the transition from a part of an operations office to a stand-alone organization reporting to the Science Chief Operations Officer. The BSO Management System includes appropriate mechanisms to provide for oversight of the LBNL ES&H programs and continuous improvement in BSO implementation of its safety management responsibilities.

BSO has enhanced its capability to perform effective ES&H oversight through extensive efforts to recruit and hire experienced ES&H professionals and through a comprehensive training and qualification program that has been specifically designed to meet the needs of oversight at a non-nuclear site. The BSO Manager ensures that adequate resources and technical expertise are applied to oversight of LBNL through the use of SC Integrated Support Center (ISC) personnel and sharing of staff with unique technical expertise with the Stanford Site Office.

As a result of BSO management efforts, the quality of oversight products is improving, as demonstrated by the good quality of recent BSO assessments. BSO oversight activities provide useful information to BSO management about ES&H performance and deficient conditions, and the information is used to promote performance improvements.

The ISC provides effective support to the BSO Manager in the conduct of assessments. Responsibility for the employee concerns and differing professional opinion programs has been recently transitioned to the ISC, and appropriate procedures have been established to implement these programs.

BSO has developed or implemented several innovative practices. The BSO Workspace (an information management system) is in the final stages of development, and when fully implemented, it will provide an automated integrated system for managing information and tasks. The BSO Workspace will also provide

an innovative mechanism to distribute lessons-learned information and facilitate tracking of actions in response to lessons learned. The BSO Manager uses the ISC to perform parallel assessments of LBNL ES&H programs and the effectiveness of BSO oversight in the same program area. With this approach, the effectiveness of BSO oversight can be evaluated with the benefit of performance data for the corresponding LBNL program.

While BSO oversight has been effective in providing performance information and facilitating improvements, continued attention and further refinement are needed, considering the level of maturity of the LBNL ISM systems. For example, recent BSO efforts, including the use of contract performance metrics, were effective in ensuring that LBNL established and implemented its new JHA process; however, increased BSO focus on the quality of LBNL JHAs and their implementation is needed. BSO has also recognized the need to add staff to improve its oversight of the LBNL radiological controls. Further, while the BSO tracking systems is generally effective in tracking corrective actions and assignments, not all operational awareness data was being entered into the system as required.

## LBNL Feedback and Improvement

LBNL has established and is implementing the elements of a contractor assurance system as identified in DOE Order 226.1A, *Implementation of DOE Oversight Policy*. The past several years have seen much improvement in strengthening contractor assurance system processes and communicating requirements to persons responsible for implementation. Safety deficiencies are being identified, evaluated, and resolved; incidents, reportable events, and injuries and illnesses are being documented and investigated; corrective and/or preventive actions are being identified; and internally and externally identified lessons learned are being identified and disseminated. However, as discussed below, most LBNL assurance system programs are not fully mature, and weaknesses in processes and procedures and deficiencies in implementation hinder fully effective implementation. Further, LBNL has not taken sufficient actions to ensure that organizations and personnel effectively address the identified performance deficiencies and comply with requirements, especially with regard to management expectations and the requirements of the self-assessment and issues management programs. (See Findings #D-1, #D-2, #D-3, and #D-4.)

LBNL has established processes for, and is conducting a variety of, self-assessment and inspection activities to evaluate safety programs and performance and identify safety deficiencies to drive continuous improvement. Although many inspections and assessments and reviews are performed, most of these self-assessment activities lack sufficient rigor or a focus on the effectiveness of people, processes, and performance in implementing ISM and safety requirements. Division self-assessments are not tailored to evaluate division-specific activities, processes, risks, and management systems. Assessment reports often inadequately categorize and identify process and performance issues, and many issues are not input to the institutional issues management system, or not input in a timely manner. (See Findings #C-4 and #D-1.)

Many safety issues are managed effectively using the institutional corrective action tracking system (CATS) and the associated issues management procedure. The procedure addresses the elements required by DOE Order 226.1 and DOE Order 414.1C, *Quality Assurance*, and it identifies responsibilities and describes the associated processes. However, the procedure provides insufficient and inappropriate direction regarding causal analysis and extent-of-condition reviews. Some safety issues were not accurately classified or described, were not entered into CATS (or not entered in a timely manner), were inadequately processed using the Laboratory issues management system, or were inadequately evaluated for cause and extent as required by DOE orders and the LBNL issues management program. (See Findings #C-4 and #D-2.)

Occupational injuries and illnesses and first aid cases are identified in accordance with Occupational Safety and Health Administration (OSHA) regulations, and recordable injuries and most first-aid cases are investigated, documented, and reported using a structured process. Based on analysis of injury data, LBNL has taken proactive and extensive actions to reduce ergonomic injuries. However, LBNL investigations and corrective actions often do not identify and establish effective recurrence controls, especially for non-OSHA-recordable injuries, because of various process and performance weaknesses, such as inadequate description of the incident details, failure to identify and address ISM core function deficiencies, inadequate identification of causes, and insufficient recurrence controls. (See Finding #D-3.)

Events requiring reporting to DOE are properly identified, reported, and investigated, and related issues are resolved in accordance with formal processes that are defined in the ES&H Manual and the issues management program manual. Although many events are properly identified, investigated, and managed, there are multiple, redundant process documents, as well as some process and implementation deficiencies. Event categorizations and DOE notifications have not always been timely, and some investigations and associated preventive actions did not sufficiently identify and address work control deficiencies and extent of condition. Most significance category 4 reportable events were insufficiently investigated, and corrective actions were not managed in accordance with the site issues management process. (See Findings #C-4 and #D-2.)

Lessons learned are generated from local incidents and events, and locally generated and external operating experiences are disseminated to targeted audiences and applied to work activities. The Independent Oversight team observed sharing of lessons learned during safety meetings and pre-job briefings in line organizations. However, program effectiveness is hindered by process and implementation weaknesses and deficiencies, and some pertinent external lessons are not posted to the site database and disseminated to potential users. The processes and requirements described in the Program Manual lack sufficient detail in a number of areas. Some externally generated lessons learned were not screened or adequately reviewed for applicability to LBNL, and mechanisms for ensuring and monitoring effective application have not been established. (See Findings #C-4 and #D-4.)

Various other LBNL feedback and improvement mechanisms are effectively implemented, although some process and performance weaknesses were identified. LBNL employees have various informal and formal means to communicate and obtain resolution of safety concerns, including the employee concerns program. Various activity-level feedback processes, such as critiques and walkthroughs, are implemented in the LBNL divisions. LBNL has established and effectively employs other, less formal mechanisms that provide two-way feedback between workers and management to promote continuous improvement. For example, the institutional Safety Review Committee, composed of representatives from each division, meets regularly and provides recommendations to the Laboratory Director on ES&H processes and issues. LBNL management has also recently established an informal "near hit" process in each division to encourage personnel to identify and report incidents in which injuries or reportable events were narrowly avoided; this program has resulted in the identification and correction of a number of safety concerns. In recent months, senior LBNL managers have demonstrated their commitment to and engagement in improving safety performance through forums for communicating expectations and feedback from Laboratory personnel, including an all-hands presentation conducted by the Laboratory Director and an offsite management retreat with substantial discussion of safety issues and processes.

# 5 Conclusions

Senior BSO and LBNL management involvement and support for safety at LBNL was notable. LBNL managers have demonstrated their commitment and engagement in improving safety performance through recent forums that provided for communication of expectations and feedback from LBNL personnel, including an all-hands presentation conducted by the former Laboratory Director and an offsite management retreat with substantial discussion of safety issues and processes. The engagement of senior LBNL management has helped facilitate recognition of the need for improvement and a learning environment for safety that has continued under the Interim Laboratory Director and was evident throughout this inspection. Personnel from the Office of the President of the University of California are also engaged in safety at LNBL. The BSO Manager and staff have also demonstrated their commitment to safety through their recent efforts to improve management processes and staffing and their leadership and support for safety improvements.

Because of this senior management support, the recent and ongoing LBNL initiatives have led to many improvements. The contractor assurance system has been improved and is identifying deficiencies and improving LBNL ES&H processes and performance. LBNL has also developed many new ES&H policies and guides and implemented a structured process to authorize all work at LBNL; all work observed by the Independent Oversight team was authorized in accordance with that new process. LBNL efforts to reduce or eliminate chemical hazards and reduce ergonomic injuries are also notable. BSO has also improved their ability to oversee LBNL activities by adding experienced ES&H professional staff, arranging for effective support from the ISC, and improving oversight processes and tools, including the development of the BSO Workspace.

While much improvement is evident, BSO and LBNL management recognize that further effort is necessary to ensure that the momentum for improvement is sustained until the LBNL and BSO ISM systems are fully effective and mature. Areas that warrant particular management attention include:

- Further improvement is needed in both the hierarchical structure and content of documents to ensure that requirements are captured and expectations are clearly articulated and followed.
- Further work is necessary to ensure that all hazards are identified and controls communicated to individuals involved with the work.
- Contractor assurance system processes need strengthening, and implementation of these processes is not yet consistently effective. Further effort is necessary to improve the rigor and focus on performance and conformance to requirements.

Senior BSO and LBNL management recognize the need for further improvement and have been successful in communicating their expectations for continuous improvement to lower tiers of management. The LBNL

ISM Improvement Project Plan provides a good baseline for consolidating needed improvement actions. The Plan could be further enhanced by identifying key areas for improvement and integrating actions within these areas so that it provides a better mechanism for managing further ISM improvements. The Plan could also be used by both LBNL and BSO management to identify opportunities to perform targeted evaluations of the effectiveness of improvement actions.

# 6 Ratings

The ratings reflect the current status of the reviewed elements of BSO and LBNL ES&H programs.

## Work Planning and Control – Core Functions #1-4

| ACTIVITY | CORE FUNCTION RATINGS | | | |
|---|---|---|---|---|
| | **Core Function #1 – Define the Scope of Work** | **Core Function #2 – Analyze the Hazards** | **Core Function #3 – Develop and Implement Controls** | **Core Function #4 – Perform Work Within Controls** |
| Advanced Light Source | Effective Performance | Effective Performance | Effective Performance | Effective Performance |
| Physical Biosciences Division | Needs Improvement | Needs Improvement | Needs Improvement | Effective Performance |
| Chemical Sciences Division | Needs Improvement | Needs Improvement | Needs Improvement | Effective Performance |
| Life Sciences Division | Needs Improvement | Needs Improvement | Needs Improvement | Effective Performance |
| Maintenance and Fabrication | Needs Improvement | Needs Improvement | Needs Improvement | Needs Improvement |
| Construction | Effective Performance | Effective Performance | Needs Improvement | Effective Performance |

| FEEDBACK AND CONTINUOUS IMPROVEMENT – CORE FUNCTION #5 | |
|---|---|
| DOE Oversight | Effective Performance |
| LBNL Feedback and Improvement | Needs Improvement |

## Purpose and Definitions of Ratings

The Office of Enforcement and Independent Oversight uses a three-tier rating system that is intended to provide line management with a tool for determining where resources might be applied toward improving ES&H. It is not intended to provide a relative rating between specific facilities or programs at different sites because of the many differences in missions, hazards, and facility life cycles, and the fact that these reviews use a sampling technique to evaluate management systems and programs. The rating system helps to communicate performance information quickly and simply. The three ratings and their definitions are:

- Effective Performance (Green): Assigned when the system being inspected provides reasonable assurance that the identified protection or program needs are met (overall performance is effective). The element being inspected is normally rated Effective Performance if all applicable standards are met and are effectively implemented. An element is also normally rated Effective Performance if, for all standards that are not met, other systems or compensatory measures exist that provide equivalent protection, or if the impact of failure to fully meet an applicable standard is minimal and does not significantly degrade the protection provided. Line managers are expected to effectively address any specific deficiencies identified.

- Needs Improvement (Yellow): Assigned when the system being inspected only partially meets identified protection or program needs or is not sufficiently mature and robust to provide assurance that the protection or program needs are fully met. The element being inspected is normally rated Needs Improvement if one or more of the applicable standards are not met and are only partially compensated for by other systems, and the resulting deficiencies degrade the effectiveness of the inspected system. Line managers are expected to provide sufficient attention to ensure that identified areas of weakness are effectively addressed through corrective actions and/or ongoing initiatives.

- Significant Weakness (Red): Assigned when the system being inspected does not provide adequate assurance that the identified program needs are met. The element being inspected is normally rated Significant Weakness if one or more of the applicable standards are not met, there are no compensating factors to reduce the impact on system effectiveness, and the resulting deficiencies seriously degrade the effectiveness of the inspected system. Line managers are expected to apply immediate attention, focus, and resources to the deficient program areas.

# APPENDIX A
# Supplemental Information

## A.1 Dates of Review

| | |
|---|---|
| Planning Visit | January 6-8, 2009 |
| Onsite Inspection Visit | January 26-February 5, 2009 |
| Report Validation and Closeout | February 24-26, 2009 |

## A.2 Review Team Composition

### A.2.1 Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
Michael A. Kilpatrick, Deputy Chief for Operations, Office of Health, Safety and Security
William Eckroade, Acting Deputy Chief for Technical Matters, Office of Health, Safety and Security
John Boulden, Acting Director, Office of Independent Oversight and Office of Enforcement
Thomas Staker, Director, Office of ES&H Evaluations

### A.2.2 Quality Review Board

| | | | |
|---|---|---|---|
| Michael Kilpatrick | William Eckroade | John Boulden | Thomas Staker |
| Dean Hickman | Robert Nelson | William Sanders | Pete Turcic |

### A.2.3 Review Team

Thomas Staker, Team Leader

| | | | |
|---|---|---|---|
| Jimmy Coaxum | Larry Denicola | Janet Macon | Marvin Mielke |
| Bob Compton | Al Gibson | Joe Lischinsky | Jim Lockridge |
| Ed Stafford | Mario Vigliani | | |

### A.2.4 Administrative Support

Mary Ann Sirk
Tom Davis

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# APPENDIX B
# Site-Specific Findings

| FINDING STATEMENTS | |
|---|---|
| C-1 | The LBNL job hazard analysis process design and implementation does not sufficiently ensure that all hazards at the activity level are systematically identified, analyzed, and controlled, as needed to ensure compliance with 10 CFR 851, *Worker Safety and Health Program*, DOE Policy 450.4, *Safety Management System Policy*, and the *LBNL Health and Safety Manual*. |
| C-2 | The LBNL non-radiological exposure assessment program does not include adequate exposure assessment procedures and protocols and does not perform sufficient qualitative and quantitative exposure assessments to fully meet the requirements of the LBNL Worker Safety and Health Plan and 10 CFR 851, *Worker Safety and Health Program*. |
| C-3 | LBNL has not established and implemented sufficient radiation protection requirements in the areas of radiological work authorizations, contamination control, radiological postings and boundary control, technical basis documentation, and training, as needed to ensure adequate radiological safety consistent with all applicable requirements of 10 CFR 835, *Occupational Radiation Protection*. |
| C-4 | LBNL has not established effective processes and rigorous documents that consistently and effectively communicate safety expectations and requirements to LBNL employees and contractors, as required by Criteria 1, 4, and 5 of DOE Order 414.1C, *Quality Assurance*. |
| C-5 | LBNL has not ensured that all of the requirements of LBNL PUB-3000, Chapter 8, Electrical Safety, Chapter 18, *Lockout/Tagout and Verification*, and NFPA 70E, *Standard for Electrical Safety in the Workplace*, for arc flash protection, PPE, and zero voltage verification have been effectively implemented. |
| D-1 | LBNL has not established and implemented a fully effective self-assessment program with sufficient rigor to ensure that safety programs and performance are consistently and accurately evaluated and deficiencies identified to ensure continuous improvement, as required by DOE Order 226.1A, *Implementation of Department of Energy Oversight Policy*, and DOE Order 414.1C, *Quality Assurance*. |
| D-2 | The LBNL issues management program is not fully effective in ensuring that ES&H-related events, injuries, conditions, and program and performance deficiencies are rigorously categorized, analyzed, and corrected and that recurrence controls are established as required by DOE Order 414.1C, *Quality Assurance*, and DOE Order 226.1A, *Implementation of DOE Oversight Policy*. |
| D-3 | LBNL has not established sufficient processes or implemented a fully effective investigation and reporting program for occupational injuries and illness to identify ISM deficiencies and implement effective recurrence controls as required by DOE Manual 231.1-1A, *Environment Safety and Health Reporting Manual*; DOE Order 414.1C, *Quality Assurance*; and DOE Order 226.1A, *Implementation of DOE Oversight Policy*. |
| D-4 | LBNL has not established and implemented a fully effective lessons-learned program that demonstrates application of some pertinent, externally generated lessons learned as required by DOE Order 210.2, *DOE Corporate Operating Experience Program*, and DOE Order 226.1A, *Implementation of DOE Oversight Policy*. |

| FINDING STATEMENTS | |
|---|---|
| E-1 | LBNL has not implemented an effective process to ensure that: all hazardous chemicals are captured in the CMS; all secondary containers, except for immediate use, are appropriately labeled with the identity of the hazardous chemical and appropriate warnings; and chemicals are properly stored, as required by 29 CFR 1910.1200, *Hazard Communication*; 29 CFR 1910.1450, *Occupational Exposure to Hazardous Chemicals in Laboratories*; or the LBNL CHSP. |