EVALUATION OF INTEGRATED SAFETY MANAGEMENT

AT LAWRENCE BERKELEY NATIONAL LABORATORY

FINAL REPORT

November 2006

1009 Bay Ridge Avenue – Suite 151
Annapolis, MD 21403
410-268-7415

M[C]CALLUM-TURNER
Denver · Washington

November 20, 2006

Dr. Steven Chu, Director
Lawrence Berkeley National Laboratory
1 Cyclotron Road, MS 50A-4119
Berkeley, CA 94720

Reference: Final Report – Evaluation of Integrated Safety Management at Lawrence Berkeley National Laboratory (LBNL)

Dear Dr. Chu:

Please find attached the final report – "Evaluation of Integrated Safety Management at Lawrence Berkeley National Laboratory". This report represents the culmination of several months of cooperative effort with a number of personnel at LBNL and reflects the review team's best professional judgment in providing a balanced evaluation of the state of Integrated Safety Management at LBNL. Our evaluation was aided in no small part by the commitment and cooperation of individuals from across the Laboratory, and we wish to thank you and your staff for their efforts.

On behalf of McCallum-Turner, Inc. and the entire review team, I want to thank you for the opportunity to support your Laboratory; we wish you and LBNL continued success and look forward to our continuing association.

Best Regards,

Robert F. McCallum, Principal
McCallum-Turner, Inc.

cc: David McGraw, LBNL
Howard Hatayama, LBNL
Jim Krupnick, LBNL
John Seabury, LBNL
Kyle Turner, McCallum-Turner, Inc.

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Team Member Signatures

Mr. Robert McCallum – Team Leader, McCallum-Turner, Inc.

Dr. Kyle Turner – Deputy Team Leader, McCallum-Turner, Inc.

Mr. Michael Bebon – Brookhaven National Laboratory

Mr. Steve Coleman – Brookhaven National Laboratory

Mr. Chris Johnson – Brookhaven National Laboratory

Mr. Edward Lessard – Brookhaven National Laboratory

Mr. Larry McClellan – Pacific Northwest National Laboratory

Mr. Thomas Mullen – Argonne National Laboratory

Mr. Douglas Schlagel – McCallum-Turner, Inc.

Ms. Carol Scott – Oak Ridge National Laboratory

Mr. Patrick Wright – Pacific Northwest National Laboratory

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LIST OF ACRONYMS

AHD	Activity Hazard Document
ALS	Advanced Light Source
ARR	Accelerator Readiness Review
BSO	Berkeley Site Office
CAMS	Corrective Action Management System
CATS	Corrective Action Tracking System
DOE	Department of Energy
EHS	Environment, Health, and Safety
EMS	Environmental Management System
ESD	Earth Sciences Division
FY	Fiscal Year
HEAR	Hazard Equipment, Authorization, and Review
IFA	Integrated Functional Assessment
ISMS	Integrated Safety Management System
JHA	Job Hazard Analysis
JHQ	Job Hazard Qualification
LBNL	Lawrence Berkeley National Laboratory
MESH	Management Environment, Safety, and Health (Review)
NCEM	National Center for Electron Microscopy
NFPA	National Fire Protection Association
OIA	Office of Institutional Assurance
OSHA	Occupational Safety and Health Administration
OSSEPP	Off-Site Safety and Environmental Protection Plan
PI	Principal Investigator
PPE	Personal Protective Equipment
RPM	Regulations and Procedures Manual
RWA	Radiological Work Authorization
SA	Self-Assessment
SAA	Satellite Accumulation Area
SAD	Safety Assessment Document
SME	Subject Matter Expert
UCB	University of California Berkeley
USI	Unreviewed Safety Issue
WOW	Workers Observing Workers
WSS	Work Smart Standards

EXECUTIVE SUMMARY

Background. In July 2006, a Department of Energy (DOE) validation review of a Lawrence Berkeley National Laboratory (LBNL) Corrective Action Plan recommended that LBNL should conduct a more comprehensive review of the implementation of its Integrated Safety Management System (ISMS). Accordingly, the Laboratory determined that an overall evaluation of its ISMS should be conducted and requested that a highly credible team of recognized Office of Science Laboratory and consultant experts with broad understanding of ISMS and the critical principles under which LBNL is managed be assembled to perform such a review. The objective of the ISMS Review was to determine the performance – areas of weakness, strength, and best practices – of selected elements of Laboratory operations with respect to the Core Functions (and associated Guiding Principles) of ISMS. The on-site portion on the ISMS Review was conducted from September 17-27, 2006; the results of the Laboratory ISMS Review are summarized below. In parallel with this review, an evaluation was also conducted of the ISMS activities of the DOE Berkeley Site Office (BSO). A separate report documents the results of the BSO ISMS Review.

Scope and Approach. The Review scope involved three elements: (1) examining Laboratory activities and operations in the areas of (a) large-scale experimental work planning and control, (b) bench-scale experimental work planning and control, and (c) maintenance operations work planning and control with respect to the ISMS Core Function and Guiding Principle framework; (2) examining critical institutional process including (a) contractor assurance, (b) self-assessment, (c) corrective action management, (d) line accountability processes, (e) Work Smart Standards, and (f) work planning and control; and (3) examining Laboratory performance in the functional areas of Radiation Protection, Industrial Safety, Industrial Hygiene, Waste Management, and Environmental Protection. The Review approach involved evaluating the above elements in the context of the five Core Functions and selected Guiding Principles of ISMS. In the execution of this approach, the review team relied heavily on the documented lines of inquiry established by the DOE Headquarters Office of Health, Safety and Security (specifically, the Office of Environment, Safety and Health Evaluations [HS-64]). These lines of inquiry were used as guidance materials by the review team in establishing targeted questions focused on the selected areas of interest.

Summary of Results. Senior LBNL management has a strong sense of ownership and accountability for safety performance, and a clear expectation that this level of safety ownership must be demonstrated across the Laboratory. Recent initiatives to communicate and implement line management ownership of safety are apparent, and are indicative of a recognition that additional effort is necessary to ensure full communication and understanding of expectations for safety ownership at LBNL. However, there does not appear to be a single, overarching set of Laboratory safety principles, behaviors, and expectations for line managers, subject matter experts and staff in general. Safety leadership and implementation of line management responsibilities for safety are uneven across LBNL organizations. Frequency of line management presence in work places varies by organization, and Job Hazard Analyses (JHAs) are in some cases developed by environment, health and safety (EHS) personnel only, without line management participation.

Technicians, crafts persons and research personnel generally understand their safety responsibilities and were observed to comply with safety requirements. Personnel understand that management places a high priority on safety and that they are expected to "Stop Work" if they have any question about safety. Personnel also appear to understand their responsibility and authority to suspend and reconsider work in unsafe situations that present less than imminent risks. Safety Coordinators and EHS Safety Liaisons are hard-working, committed, and competent, although safety professionals assigned to divisions are not receiving adequate funding and recognition for their Liaison role. There is evidence of a lack of compliance with some existing Laboratory-level procedures (e.g., hard hat use for crane operations, use of personnel protective equipment [PPE], and evidence of food and beverage consumption in laboratory spaces where chemicals are used). The condition of some laboratories (e.g., extremely cluttered laboratory spaces and bench tops) reflects a lack of understanding of the relationship between housekeeping and safety.

There is a documented, structured change management process for identifying and evaluating the applicability of new requirements and translating these requirements, as applicable, into the formal Work Smart Standards (WSS) set. Clear guidance has been provided for executing this process at the institutional level. Although there are change control processes for the Regulations and Procedures Manual (RPM) and PUB-3000, there does not appear to be institutional guidance or processes for translating new requirements into lower level implementing procedures, and there is some uncertainty on how requirements below the WSS level are processed and incorporated into implementing constructs (e.g., procedures).

The Laboratory has a documented, structured process at the institutional level for assuring that contractual commitments, including performing work safely, meeting mission and customer expectations, and continuous improvement, are met. Institutional initiatives are being undertaken to improve ISMS performance across LBNL. Reconfiguration of the Integrated Functional Assessment (IFA) process is expected to improve the effectiveness of this assessment function in supporting performance measurement and assurance processes. LBNL has not fully implemented an integrated, comprehensive Corrective Action Management System (CAMS) that provides guidance and processes for managing corrective actions to effective closure; the full suite of mechanisms and functionality for fully effective corrective action management has not clearly been established or integrated. Elements of the Self Assessment (SA) processes applied at LBNL are not fully robust in terms of effective measurement of organizational performance. The SAs are not consistently and comprehensively examining performance to organizational missions, delivery of required functionalities, or the degree to which objectives are being achieved. SAs do not clearly measure performance against institutional EHS objectives, and do not align across all organizational elements to reflect an integrated basis for LBNL performance measurement.

In terms of user facility operations, the Advanced Light Source (ALS) has a strong beamline and experimental safety review process, which is documented in a Beamline Manual. The Molecular Foundry has a strong (but not formally authorized) hazards assessment and control policy for nanoparticles; the Foundry adheres to the draft national nanoparticle safety policy. Strong Safety Circles at the worker level were observed in the ALS and at the Molecular Foundry. ALS has a weekly Operators "critique" meeting. There is an overarching value for safety at the ALS, as expressed by the Director, to support "excellence in science in a safe environment."

Most hazard controls seem to be well implemented in those divisions that operate user facilities. ALS staff indicated they were provided with the tools and PPE needed to perform work safely. The divisions reviewed have several policies to limit or eliminate hazard exposure. Worker-planned work is not consistently planned, performed, reviewed, or documented. Decisions on risk level are left to the judgment of the individual worker to determine whether a particular job is below the threshold of work which requires a procedure or job package review before beginning. LBNL PUB-3000 does not provide guidance for hazard assessment at a level to assure uniform safe practices Laboratory-wide. There is no LBNL-wide detailed guidance for oxygen deficiency hazard assessment, magnetic field safety requirements, Accelerator Safety Order requirements, cryogenic safety hazard assessments or user safety issues. PUB-3000 identifies the Accelerator Safety Order, DOE 420.2B, as a standard to be followed by LBNL accelerators; however, there is no institutional level practice detailing requirements for compliance.

In bench-scale research and development, processes for establishing work scopes are generally effective and several divisions are identifying hazards at the proposal stage of projects. Hazard analysis and control processes are variable, with some excellent practices and other practices that do not appear adequate. The Earth Sciences Division (ESD) uses an Off-Site Safety and Environmental Protection Plan (OSSEPP) to address the unique hazards of off-site work. This best practice provides an excellent example of how the Division has gone beyond PUB-3000 minimum requirements for hazard analysis and work authorization. Conversely, while high-hazard work (e.g., radiological work, work with high-power lasers, and work with highly toxic gases) is typically well analyzed and authorized through formal work authorization documents, much potentially hazardous work is left to "skill of the craft." Other DOE Science Laboratories have much lower thresholds for documented hazard analysis and authorization of potentially hazardous work. Documented hazard analysis is required by the Occupational Safety and Health Administration (OSHA) for some types of work not included in LBNL formal work authorization criteria (e.g., use of PPE).

Personnel performing bench-scale activities do not appear to be fully engaged in hazard identification and management. Although staff must read and understand Activity Hazard Documents (AHDs), there is no mechanism for them to contribute to the final product. Work is typically performed within established controls. Examples include the Actinide Science group within the Chemical Sciences Division, the Joint Genome Institute, and the Bergman group in the College of Chemistry on the University of California Berkeley (UCB) campus. There is a significant difference between divisions in the areas of: (1) housekeeping in workspaces and maintenance/condition of equipment; (2) degree of engagement and leadership exhibited by the Division Director and Principal Investigators (PIs) in terms of frequency and effectiveness of communication; (3) compliance with safety requirements (notably safety glasses); (4) engagement of Division Directors, PIs, Safety Coordinators, and staff in self-assessment; (5) level of detail and effectiveness of organization/facility-specific training; and (6) formality of operations.

Managers and supervisors in the Facilities Division are clearly dedicated to keeping their people safe. The Division Director's practice of meeting one-on-one with all new Division employees to discuss safety expectations is a noteworthy practice. Managers' work observations and the Workers Observing Workers (WOW) program are effective at raising safety awareness. The Facilities Division Director routinely walks through Division facilities and observes work in progress. The WOW program combines the benefits of safety observations, worker involvement in safety, and peer pressure to increase safety awareness and eliminate unsafe behaviors. In terms of hazard analysis and application of controls, the Hazard Equipment, Authorization, and Review (HEAR) database does not receive data from the various databases maintained by the Industrial Hygiene Group. As a result, it is typically not used by Facilities work planners, supervisors and workers. For jobs determined by supervisors to be "skill of the craft" jobs, workers are responsible for completing the Job Hazards Analysis (JHA) form. In some shops, supervisors do not review the JHA completed by the worker before the work is completed.

Construction safety documentation and associated processes need improvement. Signed contractor and subcontractor health and safety plans are not kept at the construction site, making it unclear if the most current (approved) versions are being used. These plans, including the activity hazards analysis/hazard abatement plans, are not specific as to the PPE required for construction tasks. Some construction safety documents are being approved by the EHS staff rather than the project managers as required by procedure. The penetration permit system is very labor intensive compared to the short life of the permit. Contractor performance on LBNL projects is not formally collected and used in subsequent contractor evaluation and selection processes.

In the area of training and competency, the Job Hazard Qualification (JHQ) process is formal, comprehensive and updated annually by each supervisor. To increase safety awareness and responsibilities, supervisor training is being provided to line managers. EHS Liaisons are highly qualified professionals who exhibit necessary technical and interpersonal skills, and are dedicated to both the Laboratory's success and their professional ethics. Training policies at the National Center for Electron Microscopy (NCEM) are very strong. However, the practice of allowing workers who have not been trained to work under observation by other (trained) workers does not provide full assurance of adequate worker qualifications at the bench level. There is no process to validate hazard recognition skill for Facilities craft personnel. Worker awareness of perceived low-risk hazards is expert-based and such hazards are not formally analyzed. LBNL lacks requirements for safety training of vendors and contractors.

Potential hazardous waste-generating activities are commonly identified early in the work planning process. Waste Generation Assistants, within the EHS Division, are assigned to assist each of the divisions generating hazardous waste and provide assistance in work planning. The hazardous waste management program appears to be an effective and valued program. The effective identification of environmental protection issues is dependant on the familiarity of EHS Liaisons for formal authorizations and Division Safety Coordinators for line management authorizations. Safety Coordinators and EHS Liaisons may not be adept at consistently identifying situations where environmental expertise should be consulted. An annual Management Review of the EMS program is conducted, which is a valuable tool in enhancing program visibility and resource needs.

Recommendations.[1]

1. Re-emphasize expectations for line accountability and responsibility for safety, and strengthen implementing processes by: (a) assuring that safety behaviors are clear, formal and understood; (b) assuring that line management authority is unambiguous, universally understood and accepted; and (c) assuring that existing policies are fully understood, accepted and implemented. *(Guiding Principles 1, 2, and 5)*

2. Restructure and refine institutional EHS/ISMS documents by: (a) clarifying the hierarchy, functionality, and relationship among institutional documents (e.g., RPM, PUB-3000, Operating and Assurance Plan/Quality Assurance Plan, Assurance Plan, etc.); (b) providing an overarching set of Laboratory safety values, principles, and expectations for individual position descriptions; and (c) establishing an explicit process for translating new requirements into implementing practices. *(Guiding Principles 1, 2 and 5)*

[1] The ISM Guiding Principles and Core Functions associated with each recommendation are indicated in parentheses.

3. Increase the rigor of the performance management process by: (a) assuring performance objectives are derived from overarching EHS and operational goals and objectives; (b) assuring performance objectives form the basis for monitoring organizational and functional performance; (c) developing processes for monitoring and verifying system maturation; and (d) more thoroughly identifying, communicating, and using internal best practices. *(Core Function 5)*

4. Fully implement an integrated Corrective Action Management System by: (a) establishing clear responsibilities for action ownership through the entire process; (b) providing enhanced guidance and functionalities for a graded approach to causal analysis, extent of condition, verification of closure, and effectiveness reviews; and (c) monitoring system performance and effectiveness. *(Core Function 5)*

5. Strengthen Laboratory SA processes by: (a) structuring the Division SA process around Division-specific EHS and operational performance objectives aligned with institutional expectations; (b) incorporating expectations associated with Management Environment, Safety and Health Reviews (MESH) reviews into Division self-assessments; (c) incorporating a prioritization process for identifying and conducting Division SA activities based on mission objectives and evaluation of organizational risk; (d) conducting institution-wide program evaluations (e.g., IFAs) on a risk-prioritized basis; and (e) providing assurance that these processes/programs are conducted effectively, are implemented properly, and result in identifiable improvements to performance. *(Core Function 5)*

6. Increase the rigor and consistency of the work planning and control processes, with the following focus and objectives. In the research and development area – (a) reconsider, develop, and deploy minimum standards and expectations for allowing workers to interact with hazards before they have been fully qualified; (b) re-examine the very high (as compared to other Laboratories) threshold of hazard that triggers the use of more formal hazard analysis and authorization; (c) develop effective and efficient ways to identify, communicate, and demonstrate control of lower risk/common hazards; (d) establish an up-to-date Safety Assessment Document (SAD), an Unreviewed Safety Issue (USI) procedure and a clear and widely known shielding policy for ionizing and non-ionizing radiation. In the facilities and operations area – (a) establish a process to make sure workers are skilled in hazard recognition; (b) make certain that hazard information is current through implementing the HEAR database upgrades; (c) tailor Maximo-generated JHA checklists for specific crafts to improve relevancy and encourage use; (d) post approved and current construction authorization and safety documents at jobsites; (e) streamline the penetration (dig) permit process; and (f) ensure that the documented process for operations and maintenance maintainability reviews of engineering drawings and specifications (prior to construction) is being followed. *(Guiding Principles 3, 5, 6 and 7; Core Functions 2, 3, and 4)*

7. Ensure that the ISMS-related elements of LBNL-UCB relationship are consistently articulated and clearly understood, including (a) institutional accountability for safety management and performance of LBNL-funded work conducted in UCB-controlled spaces; (b) comprehensive identification of laboratory locations and individuals performing LBNL-funded work in UCB-controlled spaces; and (c) processes by which LBNL is assured that the UCB laboratories achieve "equivalent protection" for LBNL-funded work conducted in UCB-controlled spaces. *(Guiding Principles 1 and 2)*

EVALUATION OF INTEGRATED SAFETY MANAGEMENT AT LAWRENCE BERKELEY NATIONAL LABORATORY

1.0 BACKGROUND

In July 2006, a DOE validation review of an LBNL Corrective Action Plan recommended that LBNL should conduct a more comprehensive review of the implementation of its ISMS. Accordingly, the Laboratory determined that an overall evaluation of its ISMS should be conducted and requested that a highly credible team of recognized Office of Science Laboratory and consultant experts with broad understanding of ISMS and the critical principles under which LBNL is managed be assembled to perform such a review.

The thirteen-person review team was composed of personnel from (1) Argonne National Laboratory; (2) Brookhaven National Laboratory; (3) Pacific Northwest National Laboratory; (4) Oak Ridge National Laboratory; (5) the DOE Oak Ridge Operations Office; and (6) selected consultant resources (McCallum-Turner, Inc.).

The objective of the ISMS Review was to determine the performance – areas of weakness, strength, and best practices – of selected elements of the Laboratory operation with respect to the Core Functions (and associated Guiding Principles) of ISMS and, in doing so, determine the overall effectiveness of the LBNL ISMS in satisfying the DOE ISM requirements.

A scoping and planning meeting was conducted at the Laboratory on August 8-9, 2006. The on-site portion of the Review was conducted during the period of September 17-27, 2006; the scope, approach, results, conclusions, and recommendations of the Laboratory ISMS Review are summarized herein. In parallel with this review, an evaluation was also conducted of the ISMS activities of BSO. The BSO and LBNL ISMS reviews were coordinated to address areas of interface between the two organizations, as applicable; a separate report documents the results of the BSO ISMS Review.

2.0 SCOPE AND APPROACH

The scope of the Review involved three basic elements:

- Examining Laboratory activities and operations in the areas of (a) large-scale experimental work planning and control, (b) bench-scale experimental work planning and control, and (c) maintenance operations work planning and control – all with respect to the ISMS Core Function and Guiding Principle framework;
- Examining critical institutional processes including (a) contractor assurance, (b) self-assessment, (c) corrective action management, (d) line accountability, and (e) Work Smart Standards; and
- Examining Laboratory functional or programmatic performance in the topical areas of Radiation Protection, Industrial Safety, Industrial Hygiene, Waste Management, and Environmental Protection.

The overall approach to the conduct of the Review was to evaluate the above elements in the context of the five Core Functions and selected Guiding Principles of ISMS. In the execution of this approach, the review team relied heavily on the documented lines of inquiry established by HS-64. These lines of inquiry were used as guidance materials by the review team in establishing targeted questions focused on the selected areas of interest.

As part of the planning process for this Review, the review team requested and the Laboratory provided critical documents relating to ISMS performance in the scope areas of interest. The review team conducted numerous individual and group interviews (approximately 137 personnel) with all levels of the Laboratory organization, including Senior Laboratory Management, Department Chairs, Division Directors, Group Leaders, PIs, Safety Coordinators, Maintenance and Operations Managers, Post-Doctoral Students, Technicians, Engineers, Operators, and Laborers. Key representatives of UCB were also interviewed, including representatives of the EHS organization, professors, and students. Laboratory and work area walk-throughs of representative locations where LBNL work is performed were conducted, which involved review team members interacting with Laboratory personnel in their work spaces or work setting. The review team also observed the conduct of several ISMS programmatic activities (e.g., Safety Review Committee).

The remainder of this report provides the Results of this Review (Section 3.0) and Recommendations (Section 4.0). Additional details regarding each of the functional area reviews are provided in Attachments 1-6 as follows:

- Attachment 1 – Institutional Processes
- Attachment 2 – Large-Scale User Facilities
- Attachment 3 – Bench-Scale Research and Development
- Attachment 4 – Facilities and Operations
- Attachment 5 – Worker Safety and Health
- Attachment 6 – Waste Management and Environmental Protection

Documents reviewed are identified in Attachment 7. Personnel interviewed are provided in Attachment 8. The review team is listed in Attachment 9.

3.0 RESULTS

A summary of the results of the evaluation is provided below in two formats: (1) by the Laboratory area or function reviewed, and (2) by Core Function and Guiding Principle (Table 1). The presentation is organized as follows:

- Section 3.1 – Institutional Processes
- Section 3.2 – Large-Scale Research and Development Activities
- Section 3.3 – Bench-Scale Research and Development Activities
- Section 3.4 – Facilities and Operations Activities
- Section 3.5 – Worker Safety and Health
- Section 3.6 – Waste Management and Environmental Protection
- Section 3.7 – Results by Core Function and Guiding Principle Performance

Detailed information supporting this summarization is provided in Attachments 1-6.

3.1 Institutional Processes – Line Accountability and Responsibility, Contractor Assurance, Work Smart Standards

In the area of ***line management accountability and responsibility***, senior laboratory management has a strong sense of ownership and accountability for safety performance and a clear expectation that this level of safety ownership must be demonstrated at all organizational levels. Recent initiatives and practices to communicate and implement line management ownership of safety are apparent, and are indicative of recognition that additional effort is necessary to ensure full communication and understanding of expectations for safety ownership at LBNL (supervisor training, laboratory-wide communications regarding safety expectations).

However, there does not appear to be a single, overarching set of Laboratory safety principles, behaviors, and expectations for line managers, subject matter experts and staff in general. Safety leadership and implementation of line management responsibilities for safety are highly variable across LBNL organizations. Frequency of line management presence in work places varies by organization, and JHAs are in some cases developed by EHS personnel only, without line management participation. Worker involvement in safety activities (e.g., work planning) is not consistent across the Laboratory. While formal worker safety committees have been established in some organizations (e.g., at ALS), there is little or no construct at LBNL to institutionalize worker involvement in work planning and feedback. The Laboratory does not have a consensus regarding the value of and specific requirements or expectations for Safety Liaisons. There appear to be limited safety accountability feedback mechanisms for Post-Doctoral and Graduate Students.

In the area of ***contractor assurance***, there is a documented, structured process at the institutional level for assuring that contractual commitments – including performing work safely, meeting mission and customer expectations, and continuous improvement – are met. Institutional initiatives are being undertaken to improve ISM performance across LBNL. Reconfiguration of the Integrated Functional Assessment process is expected to improve the effectiveness of this assessment function in supporting performance measurement and assurance processes.

However, LBNL has not fully implemented an integrated CAMS that provides guidance and processes for managing corrective actions to effective closure. Although a tool (CATS) is being developed for tracking corrective actions to closure, the full suite of mechanisms and functionality for fully effective corrective action management has not been clearly established or integrated. Elements of SA processes applied at LBNL are not fully robust or rigorous in terms of effective measurement of organizational performance. The SAs are not consistently and comprehensively examining performance to organizational missions, delivery of required functionalities or the degree to which these objectives are being achieved. In addition, the SAs do not clearly measure performance against institutional EHS objectives, and they do not align across all organizational elements to reflect an integrated basis for LBNL performance measurement. The implementation approach for the Office of Institutional Assurance (OIA) does not clearly reflect an overall framework for monitoring and verifying the evolution and maturation of the management systems and control processes for institutional assurance.

In the area of ***Work Smart Standards*** (WSS), there is a documented, structured change management process for identifying and evaluating the applicability of new requirements and translating these requirements, as applicable, into the formal WSS set. Clear guidance has been provided for executing this process at the institutional level. Although there are change control processes for the RPM and PUB-3000, there does not appear to be institutional guidance or processes for translating new requirements into lower-level implementing procedures, and there is some uncertainty on how requirements below the WSS level (e.g., industrial requirements, requirements identified by subject matter experts [SMEs]) are processed and incorporated into implementing constructs (e.g., procedures). Institutional command media are not clear regarding the hierarchy and relationship among documents. Organizational and functional relationships among the RPM, Operating and Assurance Plan (being translated to the Quality Assurance Plan), the Integrated Safety Management (ISM) Plan, PUB-3000, the EHS Self Assessment (SA) plan, and other assurance plans are not clearly established in terms how guidance flows from institutional level policies to implementation. At the institutional level, guidance on many EHS elements (e.g., oxygen deficiency hazards, magnetic field hazards, use of safety glasses, and transfer of liquid helium tanks in elevators) are not sufficiently specific and comprehensive to assure that the underlying requirement(s) are met without additional subordinate guidance.

3.2 Large-Scale Research and Development Activities

The ALS has a strong beamline and experimental safety review process. The input process is highly automated, and the Experimental Setup and Coordination office assures completion of the forms. There is a well-documented Beamline Design Guide that explains the beamline design and review process. There is an annual re-review of each "permanent" beamline end station. The Molecular Foundry has a strong (but not formally authorized) hazards assessment and control policy for nanoparticles; the Foundry adheres to the draft national nanoparticle safety policy. Conversely, worker-planned work is not consistently planned, performed, reviewed, or documented. No pre-job briefings are held when this work is performed, the work is not necessarily supervised, and no safety-related post-job reviews occur. Decisions on risk level are left to the judgment of the individual worker to determine whether a particular job is below the threshold of work which requires a procedure or job package review before beginning. Mechanical technicians who were interviewed at the ALS indicated that they perform work with few pre-job briefings, documented supervisor involvement or safety-related post job reviews.

Most hazard controls seem to be well-implemented in the divisions visited. ALS staff indicated they were provided with the tools and PPE needed to perform work safely. Also, the overall impression from those interviewed was that stop-work was encouraged and used in the divisions. The divisions reviewed have several policies in place that limit or eliminate hazard exposure. The ALS Beamline Scientists are required to prevent beamline operation until all safety requirements specified in beamline review have been implemented. The ALS has a policy in place to fix, free of charge, all user-supplied equipment that has safety-related problems. Work at NCEM does not involve exposed conductors. Electrical supervisors were well aware of NFPA 70E requirements, and they help assure that electrical workers comply with them. However, the proper arc flash labeling of panels and disconnects at ALS has yet to occur and it appears LBNL has not widely communicated the hazard or the NEC requirements to all workers.

LBNL PUB-3000 does not provide guidance for hazard assessment at a level to assure uniform safe practices Laboratory-wide. For example, there is no LBNL-wide detailed guidance for oxygen deficiency hazard assessment, magnetic field safety requirements, Accelerator Safety Order requirements, cryogenic safety hazard assessments or user safety issues. PUB-3000 identifies the Accelerator Safety Order, DOE 420.2B, as a standard to be followed by LBNL accelerators. However, there is no institutional-level practice that details the requirements for complying with such. As a consequence, the ALS does not have an up-to-date SAD, a USI procedure, and interviews indicated that it does not have a clear and widely known shielding policy for ionizing and non-ionizing radiation. As a result, there is no defined authorization path to achieve DOE or LBNL approval for routine accelerator operations following a significant modification.

There is some evidence that work is being conducted in the Molecular Foundry before specifying hazard controls. Interviews indicated that Division management does not perceive a value in creating a hazard control document for the Foundry and believes that reliance on Laboratory-level documents achieves proper control. Certain areas at the 88" Cyclotron accelerator (PERF areas) which may have radiation fields above 2.5 mrem/hour are secured with locked gates. However, there is no secure control over access to the keys, and the gate(s) to these areas are not interlocked to the cyclotron beam. The requirement to close the gate when radiation exists in the areas is only controlled administratively, thereby making it possible to operate the facility with unrestricted access to radiation areas if a gate is inadvertently left open. The 88" facility does utilize an experimental review process, although it is less rigorous than other facilities reviewed. The facility director determines the need for a review based on an assessment of the hazards presented by the experiment.

Strong Safety Circles at the worker level were observed in the ALS and at the Molecular Foundry. ALS has a weekly Operations "critique" meeting. There is an overarching value for safety at the ALS, as expressed by the Director, to support "excellence in science in a safe environment." The ALS has held four town hall meetings with all staff in the recent past and ALS managers received much feedback from the staff at those meetings. Monthly safety meetings are attended by both the experimental systems group and the Scientific Support Group. Operator tours of the ALS facility take place three times per day.

Notwithstanding the above constructs, workers are not consulted routinely in creating safety management systems and safety practices. Although the ALS Staff Safety Committee is an example of a strong positive element in the LBNL system, interviewed members of the committee expressed some concern that ALS senior management has not in the past seriously listened to their concerns and suggestions. Although their fears do not seem well-founded based on interviews with present ALS management, this condition indicates the efforts that are necessary to convince staff that management values their input. Similarly, based on interviews with committee members, the Molecular Foundry Safety Committee does not have a formal charter and is viewed primarily as a conduit of information to staff members. Committee members indicated there are no plans to include safety practice development or hazards assessment as part of this committee's charter. Although non-reporting was not a universally expressed motivation, some interviewees expressed the sentiment that reporting of accidents or incidents may negatively impact the Laboratory or cause their operation to be shutdown.

The JHQ process is formal, comprehensive and updated annually by each individual and his or her supervisor. All users complete the Laboratory JHQ and take all required Laboratory courses at the NCEM. The training policies at the NCEM are very strong. Users complete hands-on training and demonstrate competence before using the microscopes and then complete additional training before using microscopes during off hours. The Center established a policy that whenever a person other than the owner of an instrument uses that equipment, the instrument owner is responsible for ensuring that the user is properly trained in its use. There appear to be no LBNL requirements for safety training of vendors, some of whom provide maintenance and repair on the microscopes at the National Center for Electron Microscopy. Because the Laboratory does not ensure that vendors meet LBNL requirements (e.g., compliance with National Fire Protection Association [NFPA] 70E), the possibility exists for non-compliance with DOE requirements.

3.3 Bench Scale Research and Development Activities

Processes for establishing work scopes are generally effective. Several divisions have or are implementing a process to identify hazards at the proposal stage of a project. ESD has a Proposal Stage Safety Questionnaire. The ESD establishes an expectation in the Division ISMS plan that the scope of new work must be communicated to the authorizing authority over a workspace. This best practice is reinforced through postings on the door of each laboratory space.

The UCB/LBNL Partnership Agreement appears to be well-constructed and feasible to implement, consistent with the LBNL ISMS. The Agreement is based on equivalency between the LBNL and UCB EHS programs. The programs have similar hazard assessment/authorization triggers and use similar practices for control of hazards. However, there is a fundamental issue related to definitively identifying all work that falls under the agreement – it is not currently possible to clearly and explicitly identify all LBNL work that is being performed in UCB workspaces.

The Safety Coordinators are all hard-working, dedicated to making their managers and staff successful (including safety requirement implementation), and knowledgeable about the LBNL safety program. Most Safety Coordinators have some organizational construct supporting them (e.g., Safety Committee, Safety Wardens) that supports safety communication and hazard identification. Safety Coordinators appear to be well aware of ongoing projects and provide a vital connection between laboratory workers and institutional processes. Some EHS safety professionals assigned to divisions ("Safety Liaisons") reported that insufficient time was officially budgeted for the level of support they felt was needed (although most indicated that they spent the time needed to perform the job, and funding was ultimately not an issue). Some of the Liaisons also observed that their annual performance evaluations did not emphasize the Liaison role to the extent they believed was appropriate given the level of effort and importance of the role to the Laboratory.

Processes for hazard analysis and control are variable, ranging from some excellent practices to some practices that do not appear adequate. ESD uses the OSSEPP to addressing the unique hazards of off-site work. This best practice provides an excellent example of how the Division has gone beyond PUB-3000 minimum requirements for hazard analysis and work authorization. ESD also uses "Health & Safety – at a glance" postings to communicate important emergency information and safety expectations. Conversely, documented hazard analysis and work authorization for most work at LBNL is required by PUB-3000 to only be performed for high-hazard work. While high-hazard work such as radiological work, work with high-power lasers, and work with highly toxic gases is typically well-analyzed and authorized through the formal work authorization process, much potentially hazardous work is left to "skill of the craft." Other DOE Science Laboratories have much lower thresholds for documented hazard analysis and authorization of potentially hazardous work. Documented hazard analysis is required by OSHA for some types of work not included in LBNL formal work authorization criteria (use of PPE).

Workers do not appear to be involved in the identification and management of hazards as part of many work planning activities (even though staff must read and understand AHDs – there is no mechanism for them to contribute to the final product). There is simply a "read and understand" signature on the AHD as a requirement prior to performing work. PIs and other research and development staff with responsibility for subcontract work (e.g., vendors or specialized off-site work) are not consistently aware of their responsibilities for the safe performance of subcontracted work. There are no clear responsibilities for LBNL staff to review the hazards, approve the hazard mitigation strategy, and assure training for work performed by subcontractors.

Work is typically performed well and within established controls. Examples include the Actinide Science group within the Chemical Sciences Division, the Joint Genome Institute, and the Bergman group in the College of Chemistry on the UCB campus. Conversely, there is a significant difference between divisions in the areas of: (1) housekeeping in workspaces and maintenance/condition of equipment; (2) degree of engagement and leadership exhibited by the Division Director and PIs in terms of frequency and effectiveness of communication; (3)

compliance with safety requirements (notably safety glasses); (4) engagement of Division Directors, PIs, Safety Coordinators, and staff in self-assessment; (5) level of detail and effectiveness of organization/facility-specific training; and (6) formality of operations.

Feedback and improvement processes vary in their effectiveness. Lessons learned are distributed based on JHQ identification of hazard interactions, which allows LBNL to target lessons learned information to an audience that is most likely to benefit from it. Many enabling EHS tools that would help management and EHS personnel do their job are still in development. Experimental activities are not routinely assessed; assessments typically examine only workspace conditions and program deployment. The Corrective Action Management program has serious deficiencies. While there appears to be adequate analysis of causal factors for events, there is little evidence of performing extent-of-condition reviews and no evidence of performing effectiveness reviews once corrective actions have been instituted. In most organizations reviewed, there is no process to make sure assessment findings/actions in CATS are closed out in a timely or effective manner.

The practice of allowing bench-level workers who have not been trained to LBNL standards to work under observation by other (trained) workers does not appear to be implemented consistently or as intended. Many PIs rely greatly on prior experience of the worker and they also rely on the (untrained) worker to take the initiative to develop their own experimental plans and ask questions about issues – rather than requiring workers/PIs with responsibility for "direct supervision" of untrained workers to proactively guide the untrained worker's activities until they have been introduced to LBNL expectations through formal training and qualification.

3.4 Facilities and Operations Activities

The definition of the scope of work within the Facilities & Operations organization is typically distributed among many levels of Laboratory staff, from senior management to individual workers. Well-defined projects are established at the senior level through the use of an effective prioritization process. In the "mid-range," much work is defined by procedure, consisting primarily of utility operations and preventive maintenance work. Other work is defined by supervisors based on customer requests. Specific tasks to be performed in the field on "trouble calls" must, in most cases, be determined by the craftsperson responding.

Managers and supervisors in the Facilities Division are clearly dedicated to keeping their people safe. The Division Director practice of meeting one on one with all new Division employees to discuss safety expectations is a noteworthy practice. Workers and the safety staff supporting the Facilities Division recognize this commitment. The EHS professionals are working hard to provide the support needed to ensure injuries are prevented. The Division Director meets with every new Division employee to discuss safety expectations, and new supervisors are given an orientation by the Division Safety Coordinator. Minimum common safety training requirements have been established for all craftspersons in the Division.

In terms of hazard analysis and application of controls, the HEAR database does not receive data from the various databases maintained by the Industrial Hygiene Group. As a result, it is typically not used by Facilities work planners, supervisors and workers. Activity Hazard Documents also cannot be readily accessed by Facilities staff. For jobs determined by supervisors to be "skill of the craft" jobs, workers are responsible for completing the JHA form.

In some shops, supervisors do not review the JHA completed by the worker before the work is completed. This practice is considered a weakness since workers and supervisors do not have ready access to accurate facility hazards information, and there is no formal process to validate the hazard recognition skill of the workers.

Construction safety documentation and associated processes need improvement. Signed contractor and subcontractor health and safety plans are not kept at the construction site, making it unclear if the most current (approved) versions are being used. These plans, including the activity hazards analysis/hazard abatement plans, are not specific as to the personal protective equipment required for construction tasks. Some construction safety documents are being approved by the EHS staff rather than the project managers as required by procedure. The penetration permit system is very labor intensive due to the short life of the permit. Construction contract specifications include a comprehensive section outlining EHS requirements. Contractors are selected in part based on their OHSA logs (i.e., safety performance outside LBNL), and contractor health and safety plans (from the general contractor and their subcontractors) are required to be approved by the Laboratory before work can begin. However, contractor performance on LBNL projects is not formally collected and used in subsequent contractor evaluation and selection processes.

Managers' work observations and the WOW program are effective at raising safety awareness. The Facilities Division Director routinely walks though Division facilities and observes work in progress. The WOW program combines the benefits of safety observations, worker involvement in safety, and peer pressure to increase safety awareness and eliminate unsafe behaviors. Several improvements in procedures, PPE, equipment, and other safety aspects have been the direct result of worker feedback. While verbal feedback from workers is robust, there is no process to formally collect this information across shops, summarize it and make it available (in the form of lessons learned) to those planning future work across the Facilities Division or other organizations engaged in similar activities.

Safety training varies in its rigor and effectiveness. Workers can work for up to six months under trained supervision without having completed required training. As the Facilities Division handles over 25,000 work evolutions per year, the probability that a worker without completed training will be assigned 100% of the time to a fully trained worker is low. Although the Facilities Division Director is ensuring that the Safety Coordinator is receiving appropriate training, training and qualifications requirements have not been established for Building Managers across the Laboratory. The Building Manager program offers an excellent opportunity to augment the hazards identification and hazards control processes, but the lack of training and qualifications standards has led to Building Managers having significantly varying degrees of safety knowledge. Contractor and vendor employees performing work on-site are not provided with Laboratory-wide hazards training before commencing work onsite.

3.5 Worker Safety and Health

Workers do not appear to be adequately involved in the work planning process within research activities. The determination that a formal authorization is required is the responsibility of the work leader; however, the position of work leader is inconsistently defined and the work leader does not appear to be directly involved in the development of the formal authorization. Workers are responsible for identifying excursions from authorized work boundaries, but are not involved in the process of identifying/establishing these boundaries. The specific activity thresholds driving increased rigor in work planning (identified in PUB-3000, Chapter 6, Appendix B) appear to permit a significant amount of work and risk acceptance to be performed without formal management planning and involvement. The term "significant change" is not consistently understood when modifications to work authorizations and planning documents are required. EHS division authorization of AHDs dilutes line management ownership of responsibility for safety. The Radiological Work Authorization (RWA) work planning process requirement of a personal interview and proposed work location review between the PI and Health Physicist is a noteworthy practice.

The hazard identification process is expert-based and relies on individual decisions to consult EHS subject matter expertise when necessary and may allow incomplete identification of hazards when required expertise is not consulted. The Division Safety Coordinator plays an instrumental and valued role in hazard identification. For hazards perceived as high-risk (e.g., radiological, laser), expertise is routinely consulted. For hazards perceived as low-risk (e.g., chemical safety, hoisting/rigging), expertise is not regularly consulted. Work scopes falling below the level of a formal work authorization do not receive a thorough hazard analysis and mitigation where there are multiple interacting hazards. Interviewees commonly referred to worker expertise and educational background as an informal and necessary mechanism for identifying hazards. Chemical hazards are not clearly communicated, and worker expertise in chemical knowledge is cited as the means to identify and control hazards associated with chemical usage.

Enhanced controls for usage of x-ray systems in Building 70A were identified as a noteworthy practice. Activation of x-ray equipment is linked to a user's badge access, and access is only granted following completion of training and x-ray authorization. Additionally, real-time radiation monitoring, with output available at remote locations, provides early identification of potential inadequacies in hazard controls.

Identification and application of hazard controls is not always consistent with the hazards identified. Eye protection requirements varied among laboratory spaces with similar hazards (e.g., safety glasses not required in Life Sciences laboratory despite use of acids in laboratory processes, use of safety glasses inconsistent in Physical Biosciences laboratory [eye protection not required for personnel working adjacent to neighboring laboratory processes using chemicals]). Apparent evidence of lagging inspection of ventilation hoods was observed. Stickers affixed to ventilation hoods incorrectly identified the inspection periodicity and/or the date of the last inspection. Although an electronic record is maintained as the "official" inspection inventory, one could infer that the physical information attached to the ventilation hood is the source that most laboratory personnel would refer to in determining whether the engineering controls are effectively mitigating area hazards.

Technicians, crafts personnel and research workers generally understand their safety responsibilities and were observed to comply with safety requirements. Personnel understand that management places a high priority on safety and that they are expected to "Stop Work" if they have any question about safety. Personnel also appear to understand their responsibility and authority to suspend and reconsider work in unsafe situations that present less than imminent risks. While PUB-3000, Chapter 1, defines responsibility for situations considered to be an imminent danger, it does not establish worker responsibilities to limit work activities when the unsafe situation is less imminent. A clear authorization to commence activities does not exist for line management authorized work. There does not appear to be an institutional process to identify and control out-of-service equipment.

There is indication that some management may be passively condoning violation of existing laboratory-level procedures by ignoring or not enforcing existing requirements. It is an accepted practice in the Building 77 shop areas that crane operations involve the movement of loads directly over personnel work areas, and those personnel are not required to wear protective equipment (e.g., hard hats). This specific practice was not observed during the assessment, but personnel interviewed indicated that hard hats are not required in the area during such operations. This practice is in violation of PUB-3000, Section 5.4.5.5, Suspended Loads. Additionally, evidence of food and beverage consumption was observed in laboratory spaces where chemicals are in use (including laboratory spaces in Building 84 outside of areas designated as "clean" areas), which is in violation of the Chemical Safety and Hygiene Plan. In multiple facilities, the offices, laboratory spaces and bench tops are extremely cluttered. These poor housekeeping/fire safety practices are in violation of PUB-3000, Section 5.6, OSHA Compliance.

A significant number of safety inspections are performed throughout laboratory operations. They are most commonly performed by the Division Safety Coordinators. Identified issues are entered into a Corrective Action Tracking System, are assigned to responsible individuals, and are tracked to closure. Recently, a training class focused on walk-around training capabilities has been offered. Although there appear to be multiple safety walkthroughs in most divisions, the worker is typically not involved directly in performing these inspections, and there is little to no trending of the data obtained from the inspections. The Office of Contract Assurance develops a set of expectations that are assessed by each Division annually. While this process collects data for use by the EHS Division, it is not clear how assessment findings are utilized by other divisions. Additionally, it does not appear that divisions commonly develop organization-specific expectations that augment the EHS-developed expectations. Division self-assessments appear to be limited to safety inspections and responses to EHS expectations.

A broad cross-section of training is offered to qualify personnel. Interviewees consistently referred to laboratory-level training as the initial source of safety awareness, followed by job-specific training as a means for ensuring workplace safety. While formal documentation of worker proficiency varies, it appears that the staff are not permitted to work unsupervised without sufficient qualifications. Worker awareness of perceived low-risk hazards is expert-based, and such hazards are not formally analyzed. Workers complete a JHQ that identifies required formal training requirements, but the JHQ does not address area-specific hazard training requirements. Division Safety Coordinators are not consistently assigned based on prior safety management experience.

3.6 Waste Management/Environmental Protection

In the area of ***waste management***, potential hazardous waste-generating activities are commonly identified early in the work planning process. Waste Generation Assistants, within the EHS

Division, are assigned to assist each of the divisions generating hazardous waste and provide assistance in the work planning process when solicited. The hazardous waste management program appears to be an effective and valued program at all levels. Users consistently complimented the services provided by hazardous waste collection/management staff. Operations at the hazardous waste management facility appeared to be well-organized, controlled, and documented. Identification of waste minimization opportunities is included in the Division feedback from their annual assessment of EHS expectations.

A master inventory of Satellite Accumulation Areas (SAA) does not exist. Although LBNL procedures document a requirement to limit storage of hazardous wastes in SAAs to 9 months, without a complete inventory compliance assurance cannot be guaranteed.

In the area of ***environmental protection***, the effective identification of environmental protection issues is dependant on the insights and knowledge of EHS Liaisons for work involving formal authorizations and Division Safety Coordinators for line management authorized work. Safety Coordinators and EHS Liaisons may not be adept at consistently identifying situations where environmental expertise should be consulted. It does not appear that workers commonly associate environmental protection with the ISMS process. The EMS undergoes an annual assessment conducted by the Office of Contract Assurance. Additionally, an external assessment is conducted every three years to verify the findings of the internal assessments. An annual Management Review of the EMS program is also conducted, which is a valuable tool in enhancing program visibility and resource needs.

3.7 Results by Core Function and Guiding Principle

Table 1 outlines major observations related to the LBNL ISMS Program by Core Function and Guiding Principle. The information supporting this table derives from Sections 3.1-3.6 above as well as the series of Attachments providing further insights on the functional areas reviewed.

Table 1. Summary of Results by Core Function and Guiding Principle

Core Function or Guiding Principle	Strengths	Weaknesses/Areas for Improvement
Core Function 1 and Guiding Principle 4	• The Radiological Work Authorization work planning process requirement of a personal interview and proposed work location review between the PI and Health Physicist is a noteworthy practice • Several divisions have or are implementing a process to identify hazards at a project's proposal stage • Potential hazardous waste generating activities are commonly identified early in the work planning process (involvement of Generator Assistants and Waste Generators)	• Activity thresholds driving increased rigor in work planning (PUB-3000, Chapter 6, Appendix B) appear to permit a significant amount of risk acceptance without formal management planning and involvement • Implementation of the Partnership Agreement with UCB does not currently support clear and complete identification of the scope of work for all LBNL activities performed in UCB laboratories
Core Function 2 and Guiding Principle 6	• Safety Coordinators play an instrumental role in hazard identification	• While high hazard work (radiological, high power lasers, highly toxic gases) is typically well-analyzed and formally authorized, much

Core Function or Guiding Principle	Strengths	Weaknesses/Areas for Improvement
	• ALS has a strong beamline and experimental safety review process • The Molecular Foundry has a strong (but not formally authorized) hazards assessment and control policy for nanoparticles	potentially hazardous work is "skill of the craft" • Hazard identification is expert-based and relies on individual decisions to consult EHS subject matter expertise and may allow incomplete hazard identification when required expertise is not sought out • A master inventory of Satellite Accumulation Areas (SAA) does not exist • PUB-3000 does not provide guidance for hazard assessment at a level to ensure uniform safe practices site-wide • HEAR database is an unreliable source of facility hazards • Facilities hazards are not readily available; system relies on worker and supervisor "institutional knowledge"
Core Function 3 and Guiding Principles 5 and 6	• The ESD Offsite Safety and Environmental Protection Plan provides a best practice approach to addressing unique offsite work hazards • Enhanced controls for usage of x-ray systems in Building 70A were identified as a noteworthy practice • Blackberry Gate project is using daily Hazard Analysis/Planning process; checklist signed by LBNL Construction Manager, contractor and workers • Contractor EHS Plans are required and are approved by LBNL before construction starts	• ALS does not assure engineered safety systems are operational before startup • Contractor activity-level plans are not always explicit on required PPE
Core Function 4 and Guiding Principle 7	• Review of workspaces and interviews with staff indicated that work is typically performed safely and within established controls	• There is a significant difference between divisions in the safety culture and discipline of operations that is apparent in work performance • A clear authorization to commence work does not exist for line management authorized work (typical readiness activities are not performed) • Identification and application of hazard controls is not consistent with the hazards identified (inconsistent PPE usage) • There does not appear to be an institutional process to identify and control out-of-service equipment
Core Function 5	• Lessons learned are distributed based on JHQ identification of hazard interactions • A documented, structured process exists at the institutional level for assuring that contractual commitments are evaluated • The Engineering Division is proactively communicating the	• Worker involvement in work planning is not consistent • An integrated, comprehensive Corrective Action Management Program providing guidance and processes for managing corrective actions to effective closure has not been fully implemented • Elements of the SA processes are not fully rigorous in terms of comprehensive and

Core Function or Guiding Principle	Strengths	Weaknesses/Areas for Improvement
	concepts of ISM to division personnel • Causal analysis training is being provided • Effective safety committees are functioning at ALS • The EMS undergoes an annual assessment conducted by the Office of Contract Assurance • ALS has a weekly Operators "critique" meeting • Cross shop inspections are performed quarterly in facilities	effective measurement of organizational performance • Division SAs are largely limited to safety inspections and responses to EHS expectations • Assessment is excessively focused on unsafe conditions; activities are not routinely assessed • The implementation approach for OIA does not clearly reflect a framework for monitoring and verifying the maturation of all institutional assurance processes • Contractor/key supplier safety performance is not summarized or formally used in subsequent contractor evaluation and selection processes • Facilities and operations worker feedback and lessons learned information is not documented and not readily trended, shared across shops, and used in work planning
Guiding Principle 1	• Senior Laboratory management is committed to safety principles • Safety initiatives are being developed and implemented • Laboratory personnel are committed to safety principles • Institutional initiatives are being taken to improve ISMS performance	• Safety leadership and implementation of line management responsibilities for safety are highly variable across LBNL organizations • Limited safety accountability mechanisms exist for post-doctoral and graduate students • EHS division authorization of AHDs dilutes line management ownership of responsibility for safety • The role and responsibilities of PIs in assuring safe work performance by subcontractors is not always well understood by the PIs
Guiding Principle 2	• Institutional level documents have a variety of information on safety roles and responsibilities for Laboratory personnel	• No single overarching set of safety behaviors and expectations • The value and expectations for Safety Liaisons not fully clarified
Guiding Principle 3	• The JHQ process is formal, comprehensive and updated annually by each supervisor • Supervisor training is being provided • EHS Liaisons are highly qualified professionals who exhibit necessary interpersonal skills, and are dedicated to both the Laboratory's success and their professional ethics • Some organizations have a structured process provide safety orientation to new staff (especially students) • Training policies at NCEM are very strong	• The practice of allowing bench-level workers who have not been trained to work to LBNL standards under the supervision of other (trained) workers does not appear to be implemented consistently or as intended • There is no process to validate hazard recognition skill for Facilities craft personnel • Worker awareness of perceived low-risk hazards is expert-based and such hazards are not formally analyzed • Division Safety Coordinators and EHS Liaisons are not consistently assigned based on prior environmental protection experience, and all must be cognizant of necessity to consult with SMEs • LBNL lacks requirements for safety training of vendors and contractors • Building Manager training and qualification expectations are not clearly defined
Guiding Principle 5	• Documented, structured change	• Elements of the process for translating new

Core Function or Guiding Principle	Strengths	Weaknesses/Areas for Improvement
	management process for identifying and evaluating the applicability of new requirements and translating these requirements into the formal WSS set	WSS requirements into implementing practices (below the institutional level) are not formalized or completely understood • Institutional command media are not clear regarding the hierarchy and relationship between documents

4.0 LIST OF RECOMMENDATIONS

Provided below is a prioritized set of recommendations. These recommendations are structured to reflect actions intended to have strategic impact on the ISMS at LBNL; they are drawn from the information (observations and conclusions) presented in Section 3.0. The ISM Guiding Principles and Core Functions associated with each recommendation are indicated in parentheses.

1. **Re-emphasize expectations for line accountability and responsibility for safety; strengthen implementing processes to reflect these principles (Guiding Principles 1, 2, and 5)**

   - Assure that safety behaviors/expectations are clear, formal, understood, and implemented (see next recommendation)

   - Assure that line management authority is unambiguous, universally understood, and accepted by emphasizing that

     - Line managers provide assurance and approval of all hazard analyses and work authorization documentation,
     - Safety leadership and safety performance expectations are explicitly communicated to – and understood by – line managers including PIs, and
     - Line managers actively involve workers in work planning.

   - Assure that existing procedures are both fully understood and are being consistently followed; for example, promoting consistent and complete compliance with controls (PPE) identified in laboratory procedures and ensuring requirements are explicit.

2. **Restructure and refine institutional EHS/ISMS documents with the following focus and objectives (Guiding Principles 1, 2, and 5)**

   - Clarify the hierarchy, functionality, and relationship among institutional documents (e.g., RPM, PUB-3000, Operating and Assurance Plan/Quality Assurance Plan, and Assurance Plan).

   - Provide an overarching set of Laboratory safety values, principles, and expectations for individual position descriptions.

     - Articulate an overall statement of safety value for the Laboratory.
     - Define the highest level set of essential safety behaviors and expectations for line managers, subject matter experts, and staff in general.
     - Clarify expectations for Safety Liaisons.
     - Establish Laboratory-level training and qualification standards for Safety Coordinators.

   - Establish an explicit process for translating new requirements into implementing practices.

- Codify the role of the Safety Review Committee in Laboratory procedure.
- Ensure process for translating new requirements into lower level procedures is codified.
- Ensure that process for identifying relevant industrial requirements is systematic, formalized, and understood.

3. Increase the rigor of the performance management process (Core Function 5)

- Enhance Laboratory-level processes through
  - Assuring performance objectives are derived from overarching EHS and operational end-state goals and objectives.
  - Assuring performance objectives form basis for monitoring organizational and functional performance.
  - Developing processes for monitoring and verifying the maturation of the systems, including (a) assuring that trending and analysis activities comprehensively examine performance data and provide a basis for improvements; and (b) assuring that OIA systematically evaluates performance of the Laboratory's assurance processes (e.g., Quality Assurance Program).
  - More thoroughly identifying, communicating, and taking advantage of the best practices that are in use in some divisions.
- Enhance functional and/or organizational processes through, for example –
  - Using a formal process to evaluate subcontractor and vendor safety performance.
  - Maintaining subcontractor and vendor safety performance records for use in future selections.
  - More consistently documenting and sharing worker feedback.

4. Fully implement an integrated Corrective Action Management System, with the following objectives (Core Function 5)

- Establish clear responsibilities for action ownership through the entire process.
- Provide enhanced guidance and functionalities for graded application of:
  - Preferred causal analysis tools and their application.
  - Triggers for – and methods used to conduct – extent-of-condition reviews.
  - Level of formality and methods used to verify action closure.
  - Triggers for – and methods used to conduct – effectiveness reviews.
- Monitor timeliness and system effectiveness in achieving its objectives.

5. **Strengthen Laboratory self-assessment processes (Core Function 5)**

   - Structure the Division self-assessment process around Division-specific EHS and operational performance objectives that are aligned with institutional expectations.
   - Incorporate expectations (methods, scope, etc.) associated with MESH reviews into Division self-assessments.
   - Incorporate a prioritization process for identifying and conducting Division self-assessment activities based on mission objectives and evaluation of risks to the organization.
   - Conduct institution-wide program evaluations (e.g., IFAs) on a risk-prioritized basis, which are designed to assure that program improvements are identified and the program is fully integrated with other systems.
   - Provide assurance that these processes/programs are conducted effectively, are implemented properly, and result in identifiable improvements to performance (e.g., OIA function).

6. **Increase the rigor and consistency of the work planning and control processes, with the following focus and objectives (Guiding Principles 3, 5, 6, and 7; Core Functions 1, 2, and 5)**

   Research and Development

   - Reconsider, develop, and deploy minimum standards and expectations for allowing workers to interact with hazards before they have been fully qualified (including whether unsupervised work with certain hazards will be allowed, the level of supervision required, etc.).
   - Re-examine the very high (as compared to other Laboratories) threshold of hazard that triggers the use of more formal hazard analysis and authorization.
   - Develop effective and efficient ways to identify, communicate, and demonstrate control of lower risk/common hazards (e.g., routine use of chemicals, sharps, etc.).
   - Establish an up-to-date SAD, a USI procedure, and a clear and widely known shielding policy for ionizing and non-ionizing radiation.

   Facilities and Operations

   - Establish a process to make sure workers are skilled in hazard recognition.
   - Assure that hazard information is current by implementing the HEAR database upgrades.

- Tailor Maximo-generated JHA checklists for specific crafts to improve relevancy and encourage use.

- Post approved and current construction authorization and safety documents at jobsites.

- Streamline the penetration (dig) permit process.

- Ensure that the documented process for operations and maintenance maintainability reviews of engineering drawings and specifications (prior to construction) is being followed.

7. Assure that the ISMS-related elements of LBNL-UCB relationship are consistently articulated and clearly understood (Guiding Principles 1 and 2)

- Ensure institutional accountability for safety management and performance of LBNL funded work conducted in UCB-controlled spaces.

- Ensure comprehensive identification of laboratory locations and individuals performing LBNL funded work in UCB-controlled spaces.

- Implement processes by which LBNL is assured that the UCB laboratories achieve "equivalent protection" for LBNL-funded work conducted in UCB-controlled spaces.

ATTACHMENT 1: INSTITUTIONAL PROCESSES

This section addresses observations associated with line accountability and responsibility, contractor assurance processes (including self-assessment and corrective action management), and the WSS process.

LINE ACCOUNTABILITY AND RESPONSIBILITY – GUIDING PRINCIPLES 1 AND 2

Strengths

Observation 1: Senior Laboratory management has a strong sense of ownership and accountability for safety performance. There is a clear expectation by Laboratory management that this level of safety ownership must be reflected at all organizational levels of the Laboratory.

Observation 2: Initiatives and practices to communicate and implement line management ownership of safety are apparent. Senior management has recognized additional effort is necessary to ensure full communication and understanding of expectations for safety ownership at LBNL, and actions are being taken to address this. Supervisor training has been developed and is being delivered, which provides clear expectations for safety performance, and there is evidence that disciplinary actions based on safety performance have been – and continue to be – taken by the Laboratory. In addition, the Laboratory Director has issued several Laboratory-wide communications regarding safety expectations; the EHS directorate has developed a ("1 Minute 4 Safety") tool for use by line managers.

Weaknesses

Observation 1: There does not appear to be a single, overarching set of Laboratory safety principles, behaviors, and expectations for individual position descriptions. Safety responsibilities and expectations are documented in numerous institutional command media leading to the potential for conflict and confusion; however, these descriptions do generally establish the distinction between line and EHS responsibilities. Clarity in communications of these expectations is limited by the lack of clear hierarchy and relationships among command media. There is no single, highest level set of safety behaviors and expectations for line managers, SMEs, and staff in general.

Observation 2: Safety leadership and implementation of line management responsibilities for safety are highly variable across organizational units at LBNL. For example, frequency of line management presence in work places varies by organization, and JHAs are in some cases developed by EHS personnel only, without line management participation. Multiple observations of poor housekeeping and deviations from established safety requirements (e.g., proper PPE, maintenance of laboratory space safety configuration) in some organizations reflected a lack of line management engagement and/or effective communication of – and feedback on – safety expectations.

Observation 3: Worker involvement in safety activities (e.g., work planning) is not consistent across the Laboratory. While formal worker safety committees have been established in some organizations (e.g., at ALS to review findings from safety inspections and consult with management on safety issues), there is little or no construct at LBNL to institutionalize worker involvement in work planning and feedback. LBNL command media do not explicitly provide for worker involvement in safety planning and implementation activities.

Observation 4: The Laboratory does not have a consensus regarding the value of and specific expectations for Safety Liaisons. There is no set of consistent expectations that define the Safety Liaison role(s). There is no set of triggers that signal Safety Liaison engagement. The combination of programmatic and liaison requirements leads, in some cases, to situations where personnel cannot effectively function in all areas where their involvement is required to implement ISMS requirements. While most Safety Liaisons correctly emphasize helping their assigned organization perform work safely, some reported that insufficient time was officially budgeted for the level of support they felt was needed. Some of the Liaisons also observed that their annual performance evaluations did not emphasize the Liaison role to the extent they believed was appropriate given the level of effort and importance of the role to the Laboratory.

Observation 5: There appear to be limited safety accountability feedback mechanisms for Post-Doctoral and Graduate Students. The usual methods used to correct negative behavior (i.e., disciplinary action) appear to be unavailable. Unless the PI and the human resource organization decide to terminate a Post-Doctoral or Graduate Student, the only threat in the event of improper behavior is to withhold approval of the Post-Doctoral or Graduate Student's thesis, or withhold recommendations for future appointment at other institutions

CONTRACTOR ASSURANCE, SELF-ASSESSMENT, CORRECTIVE ACTION MANAGEMENT – CORE FUNCTION 5

Strengths

Observation 1: There is a documented, structured process at the institutional level for ensuring that contractual commitments, including performing work safely, meeting mission and customer expectations, and continuous improvement, are met. The UC Assurance Plan for LBNL establishes the basic institutional functionalities for conducting contractor assurance activities, including identification of roles and responsibilities for Laboratory management.

Observation 2: Institutional initiatives are being undertaken to improve ISM performance across LBNL. Reconfiguration of the IFA process is expected to improve the effectiveness of this assessment function in supporting performance measurement and assurance processes. The re-orientation of the focus for IFAs to address ISM processes and functionalities across organizational elements of the Laboratory will provide additional insights into the consistency and functionality of the implementation of ISM constructs and will provide additional visibility regarding meeting performance goals. The Lessons Learned Program is being enhanced to provide push-down notifications to persons whose activities relate to lessons learned via correlation with risk and performance characterized in individual JHQ.

Weaknesses

Observation 1: LBNL has not fully implemented an integrated, comprehensive CAMS that provides guidance and processes for managing corrective actions to effective closure. Although a tool (CATS) is being developed for tracking corrective actions to closure, the full suite of mechanisms for fully effective corrective action management have not clearly been established or integrated; these functionalities include guidance for:

- Determining when the corrective action process should be used;
- Determining when and how causal analysis should be conducted;
- Identifying when and how extent-of-condition reviews should be performed;
- Assigning responsibility/ownership for corrective action closure;
- Determining the level of formality and closure verification rigor; and
- Determining when and how effectiveness reviews for completed corrective actions should be conducted.

Observation 2: Elements of the SA processes applied at LBNL are not fully robust or rigorous in terms of effective measurement of organizational performance. Current SAs are conducted using a pre-established checklist that is structured around – and limited to – evaluation of organizational performance with regard to implementation of ISM Core Functions 1-5. As a result, the SAs are not clearly examining performance to organizational missions or delivery of required functionalities or the degree to which these objectives are being achieved. A corollary is that the SAs do not clearly measure performance against institutional EHS objectives, and they do not align across all organizational elements to reflect an integrated basis for LBNL performance measurement. Also, SAs conducted to the standard checklist do not clearly reflect a risk-prioritized evaluation of organizational activities and the associated priority for assessment.

Observation 3: The implementation approach for the OIA does not clearly reflect an overall framework for monitoring and verifying the evolution and maturation of the management systems and control processes for institutional assurance. For example, OIA monitoring of the SA process does not clearly focus on process effectiveness, rather, as currently being practiced, the OIA validates data developed in the organizational SAs. OIA does not appear to be proactively evaluating implementation of the Quality Assurance Program.

WORK SMART STANDARDS – GUIDING PRINCIPLE 5, CORE FUNCTION 3

Strength

Observation 1: There is a documented, structured change management process for identifying and evaluating the applicability of new requirements and translating these requirements, as applicable, into the formal WSS set. Clear guidance has been provided for executing this process at the institutional level. Standards Review Teams have been established to evaluate requirements on a topical basis with appropriate participation by SMEs and line management. Steering and Advisory Committees have been established at the senior management level to provide oversight and conflict resolution (e.g., in the case of disputes between EHS and line management on applicability) as required.

Weaknesses

Observation 1: It appears that elements of the process for translating new requirements into implementing practices is not formalized or completely understood. For example, there are change control processes for the RPM and PUB-3000, and the Safety Review Committee has authority for approval of changes to this document. However, there does not appear to be institutional guidance or processes for translating new requirements into lower level implementing procedures, and there is some uncertainty on how requirements below the WSS level (e.g., industrial requirements, requirements identified by SMEs) are processed and incorporated into implementing constructs (e.g., procedures).

Observation 2: Institutional command media are not clear regarding the hierarchy and relationship among documents. Organizational and functional relationships among the RPM, Operating and Assurance Plan (being translated to the Quality Assurance Plan), the Integrated Safety Management (ISM) Plan, PUB-3000, the EHS Self Assessment (SA) plan, and other institutional plans are not clearly established in terms how guidance flows from institutional level policies to implementation. For example, there are separate discussions of responsibilities and authorities for the same positions in multiple documents, the relationship between the Operating and Assurance Plan/Quality Assurance Plan Appendix A risk ranking methodology and work planning constructs (PUB-3000) is not clear, and the role of the Safety Review Committee in the requirements change control process is not reflected in the process guidance documents. At the institutional level, guidance on many EHS elements (e.g., oxygen deficiency hazards, magnetic field hazards, use of safety glasses, and transfer of liquid helium tanks in elevators) are not sufficiently specific and comprehensive to assure that the underlying requirement(s) are met without additional subordinate guidance.

ATTACHMENT 2: LARGE-SCALE USER FACILITIES

This section focuses on the review of ALS, Molecular Foundry, 88-Inch Cyclotron and NCEM where users are allowed to perform work along with LBNL staff. The observations below are based on walkthroughs of spaces; interviews with staff, including management, supervisors, workers, scientists, engineers and users; and a review of LBNL and facility-level documents.

Core Function 1: Define Scope of Work

Strengths

Observation 1: The ALS has a strong beamline and experimental safety review process. The review input process is highly automated. Safety questionnaires and approval forms are generated online if a user indicates a specific hazard with his or her experiment. The Experimental Setup and Coordination Office ensures completion of the forms. A check-off sheet is used for new or modified beamlines to make sure all necessary steps are followed. There is a well-documented Beamline Design Guide that explains the beamline design and review process. However, even with this documentation, it took over an hour to adequately explain the process to the review team. A simplified diagram, possibly a block diagram, would help explain the process. Copies of the documents resulting from the review process are kept at each beamline for ready reference. There is an annual re-review of each "permanent" beamline end station.

Observation 2: The Molecular Foundry has a strong (but not formally authorized) hazards assessment and control policy for nanoparticles. Molecular Foundry personnel have been involved in the development of a draft national nanoparticle safety policy, and the Foundry adheres to that policy. However, a formal authorized nanoparticle safety policy does not exist as a LBNL-wide policy and such a policy is not documented in PUB-3000.

Weaknesses

Observation 1: Worker-planned work is not consistently planned, performed, reviewed, or documented. The scope of the work is not documented for worker-planned work, which constitutes approximately 50% of the work performed in the divisions visited by the review team. No pre-job briefings are held when this work is performed, the work may or may not be supervised, and no safety-related post-job reviews are held.

Because the scope of such work is not documented, it is left up to the judgment of the individual worker to determine whether a particular job is below the threshold of work, which requires a procedure or job package review before beginning the job. The review team did not find any workers who had a clear understanding of the boundary above which a job can no longer be considered in the realm of worker-planned work.

The ALS recognizes that their work permit process is inadequate, and is hiring a new facility manager to update the process. Mechanical technicians who were interviewed at the ALS indicate that they perform work with few pre-job briefings, documented supervisor involvement, or safety-related post job reviews. The technicians believe these circumstances were due to the repetitive nature of their work and indicate that any safety issues would be reviewed at the monthly meetings. It is the view of the review team that, since the work environment may change day-to-day, all jobs need some level of review in order to make sure safety practices are sufficient.

Observation 2: Communications related to day-to-day work planning between users and staff are weak at the ALS. There is no frequent regular meeting between operations staff and the users present at the ALS. However, this condition may be addressed in the future once ALS employs more "floor operators."

Core Function 2: Analyze Hazards; and Core Function 3: Implement Hazard Controls

Strengths

Observation 1: The AHD process documents hazards and controls associated with experiments.

Observation 2: The divisions reviewed have several policies in place that limit or eliminate hazard exposure. The ALS Beamline Scientists are required to prevent beamline operation until all safety requirements specified in beamline review have been implemented. A check-off sheet is required to commission new or modified beamlines, ensuring that all required steps are completed. The ALS has a policy to fix, free of charge, all user-supplied equipment having safety-related problems. This is an example of a very strong safety-related policy and is to be commended. Electrical supervisors were well aware of NFPA 70E requirements, and they help ensure that electrical workers comply with them. The work at the NCEM does not involve exposed conductors. The Center does not allow work that involves exposing live electrical connections and does not allow use of the Wet Laboratory during off hours, because this laboratory has additional potential hazards. LBNL provides free medical examinations for those potentially exposed to hazardous materials, noise, and other physical hazards.

Weaknesses

Observation 1: PUB-3000 does not provide guidance for hazard assessment at a level to assure uniform safe practices site-wide. There is no Laboratory-wide detailed guidance for such elements as oxygen deficiency hazard assessment, magnetic field safety requirements, Accelerator Safety Order requirements, cryogenic safety hazard assessments, or user safety issues. This lack of sufficient institutional guidance may extend to other safety topics. For instance, the Laboratory has not adopted the draft nanotechnology safety policy as a Laboratory-wide policy. The Laboratory may want to consider adopting the draft, and labeling it as an interim LBNL practice, so that all LBNL divisions adhere to the same policy. This lack of guidance can lead to hazard assessment practices of various degrees of rigor in different divisions.

PUB-3000 identifies the Accelerator Safety Order, DOE 420.2B, as a standard to be followed by accelerators at LBNL. However, there is no apparent institutional-level practice that details the requirements for complying with the Accelerator Safety Order. At the Laboratory level, one would expect the following actions to be addressed, with detailed steps, in order for divisions to comply:

1. Establish the authorization path to achieve approval for routine accelerator operations;
2. Develop the Safety Assessment Document (SAD) and Shielding Policy;
3. Develop the Accelerator Safety Envelope and Commissioning Accelerator Safety Envelope;
4. Develop the Authorization Scheme (Planned Authorization Documents and Planned Commissioning Modules);
5. Charter an Accelerator Readiness Review (ARR) Team and conduct an ARR;
6. Obtain the approval for commissioning;
7. Obtain the approval for routine operations; and
8. Maintain Operations within the Approved Authorization Basis (the Unreviewed Safety Issue [USI] Process is recommended).

As a consequence of the missing elements at the institutional level, the ALS, and likely other onsite accelerators develop facility-specific solutions based on their own cost-benefit analysis, which may result in decisions to achieve business objectives such as "outstanding science" versus investing in safety-related activities. As a consequence, ALS does not have an up-to-date SAD or a USI procedure, and interviews indicate that it does not have a clear and widely known shielding policy for ionizing and non-ionizing radiation – despite having significant administrative and physical changes. There is no defined authorization path to achieve DOE or LBNL approval for routine accelerator operations following a significant modification. The situation is the largely the same for the 88" Cyclotron.

Observation 2: The ALS operations chain-of-command does not ensure engineered safety systems are operational before startup. The ALS SAD requires that the operation of all engineered safety systems be checked before startup. The fire alarm system is such an engineered safety system, yet the operations group does not ensure its operation before beam startup (for example, by documenting that the latest periodic checks for the system have been successfully completed).

Observation 3: The existing hazard controls may not be sufficient to assure safe operations. The relationship of the ALS with the fire department needs to be closely reviewed; it appears that the response of the fire department during off-hours shifts is less than ideal. The fire department does not respond to a "first-level" smoke alarm, which could lead to delayed response in the event of an emergency.

There is some evidence that work is being conducted in the Molecular Foundry before specifying hazard controls. Interviews indicated that Division management does not believe there is value in creating a hazard control document for the Foundry, and has determined that reliance on Laboratory-level documents is preferred.

Personnel interviewed did not know of a Laboratory-wide policy for the use of safety glasses (i.e., when such use is required). The lack of such a policy leads to varying degrees of rigor in applying standards.

Certain areas at the 88" Cyclotron accelerator (PERF areas) which may have radiation fields above 2.5 mrem/hour are secured with locked gates. Two keys are needed to open them. One is freely accessible on a board in the control room. Copies of the other are issued to persons with proper training (radiation worker training). The gate(s) to these areas are not interlocked to the cyclotron beam. The requirement to close the gate when radiation exists in the areas is only controlled administratively. Thus, it is possible to operate the facility with unrestricted access to radiation areas if a gate is inadvertently left open. Facility staff related that their practice is to remember to lock the gates whenever radiation fields exceed 2.5 mrem/hour.

Finally, while the 88" Cyclotron facility does utilize an experimental review process, it is less rigorous than other facilities reviewed. Completion of a review is up to the discretion of the facility director depending on the hazards presented by the experiment. Items requiring completion before the experiment can commence are tracked – albeit informally – by the Facility Director.

Core Function 4: Perform Work Within Controls

Strengths

Observation 1: Most hazard controls seem to be well implemented in the divisions reviewed.

Observation 2: ALS Management is strongly motivated to improve safety. ALS staff indicated they were provided with the tools and PPE needed to perform work safely. The overall impression from those interviewed was that stop-work was encouraged and used in the divisions.

The Howard Hughes beamline at the ALS requires users to sign off on a one-page document that lists 5 or 6 specific safety rules that MUST be followed. This is an excellent practice often used in industries having a mature safety culture and it illustrates line accountability. For example, a user at ALS knows that he or she can be held accountable for jumping the hutch wall or for not using gloves for cryogen work.

Supervision of Post-Doctoral Students at the NCEM is highly effective; the PI interviewed maintains close contact with his students, his office is physically close to their laboratory, and he discusses their work with them daily. The PI records safety transgressions by sending an email to the offending Post-Doctoral Student.

Weaknesses

Observation 1: Since the PUB-3000 does not ensure uniform LBNL practices, divisions interpret authorization processes. The lack of a Laboratory-wide accelerator authorization process leads to varying levels of quality. There is no Laboratory-wide policy on language-related safety issues with users. For example, there is no LBNL requirement to use an escort if a user cannot demonstrate they can read and correctly respond to hazard postings.

Observation 2: Weaknesses exist in working within established controls. The requirements for NFPA 70E PPE, its issuance, and its proper use, was confirmed by workers at ALS. However, the proper arc flash labeling of panels and disconnects at ALS has yet to occur. One technician in the NCEM indicated he routinely operates 220 V 30 amp panels and was not aware of NFPA 70E PPE requirements or the arc flash hazard. It appears LBNL has not widely communicated the hazard or the NEC requirements to all workers.

Observation 3: Staffing cutbacks at the ALS have resulted in potential safety vulnerabilities that need correcting. It appears that these shortfalls are being addressed by present management plans. Operator staffing, which had been on long-term decline, is now being replenished. A similar condition exists for floor operators, which is a critical ALS safety position as they are the primary interface with users.

Core Function 5: Feedback and Improvement

Strengths

Observation 1: The Safety Committee system appears to be very robust. Strong safety circles at the worker level were observed in the ALS and at the Molecular Foundry. The ALS Staff Safety Committee strives for continual improvement and excellence in safety. Every division reviewed had operating safety committees.

Observation 2: The ALS has a weekly Operators "critique" meeting, which is an excellent forum for information sharing.

Observation 3: There is an overarching value for safety at the ALS, as expressed by the Director, to support "excellence in science in a safe environment." Current ALS operations management is viewed by staff as being safety-conscious. In fact, the willingness to invest in safety was believed by the staff to exceed the rest of the Laboratory. Each beamline has an account of between $30-60K out of which safety expenditures may be made. In addition, a central account that totals about $200K is maintained for larger safety issues. (Conversely, the feeling at ALS is that non-ALS and non-Laboratory users do not value safety as an overarching priority above schedule and cost.)

The ALS has recently held four town meetings with the entire staff during which ALS managers received significant feedback. The ALS staff believes that their safety program is stronger than anywhere else at the Laboratory or on the UCB campus, indicating their belief in management's emphasis on safety. Monthly safety meetings are attended by the experimental systems group and the Scientific Support Group. Management retreats that include safety issues focus management on the topic of safety and safety improvement. An outside safety consultant (Hislop) has been hired to help create a manager walk-around protocol and train the facility's managers. The review team recommends that this program, or a similar one, be duplicated throughout the Laboratory. Operator tours occur three times per day and examine worker behaviors and facility condition, which allows evaluation of physical conditions and awareness of personnel (an insightful approach to improving safety).

Weaknesses

Observation 1: Workers are not consulted routinely in creating safety management systems and safety practices. Personnel performing work are an excellent source of information on safety improvement. Although the ALS Staff Safety Committee is an example of a strong positive element in the LBNL system, members of the committee who were interviewed expressed some concern that ALS senior management has not in the past fully addressed their concerns and suggestions. Although their fears do not seem well-founded based on interviews with present ALS management, this condition indicates the efforts that are necessary to convince staff that management values their input.

Similarly, the Molecular Foundry safety committee (which currently has no charter) is viewed by committee members who were interviewed as a conduit of information to staff members. Although the committee plans to develop one safety practice for the Foundry (transporting liquid nitrogen dewars on elevators), committee members indicated that there are no plans to include safety practice development or hazards assessment as part of the committee charter. The review team recommends that these activities be included and that local safety practices be documented and widely communicated.

Observation 2: Management walk-throughs at NCEM tend to be informal – occurring when the manager happens to be in an area. If walkthroughs do not specifically focus on safety, managers may omit that component of responsibility.

Observation 3: Interviews indicated that the Molecular Foundry does not have a policy addressing the safety review of new or modified equipment, and does not believe the Laboratory does. At the Molecular Foundry, this decision is the responsibility of the PI.

Observation 4: There were some personnel who believed that incidents may impact the Laboratory or cause their operation to be shutdown; thus, there may be a tendency for workers to hide minor injuries and near-misses, which deprives LBNL of necessary feedback. Non-reporting was not a universally expressed motivation; this suggests that management should continue efforts to minimize or eliminate this tendency by emphasizing that "concern-for-others' safety" is a pre-eminent value at LBNL.

Observation 5: The ALS daily operations log on the Laboratory web is not routinely emailed to the managers. Doing so would help make sure managers are more aware of day-to-day operations.

Guiding Principle 3: Competence Commensurate with Responsibilities

Strengths

Observation 1: The JHQ process is formal, comprehensive and updated annually by each individual and his supervisor. All users complete the full Laboratory JHQ and take all required Laboratory courses at the NCEM. Users complete hands-on training and demonstrate competence before using the microscopes, and then complete additional training before using microscopes during off-hours. This is a strong practice and the review team recommends that it should be carefully studied by the ALS, whose training program for users is not as comprehensive.

Observation 2: The safety training policies at the NCEM are very strong. The Center has instituted a program whereby a few PIs have been selected to teach safety training to other PIs. This program has been enthusiastically embraced and is viewed as highly effective. The Center is considering expanding this program to provide for selected students to teach safety principles to other students. The Center has also established a policy that whenever a person other than the owner of an instrument uses that equipment, the instrument owner is responsible for ensuring that the user is trained in its proper use. This policy increases the likelihood that all instruments are used properly.

Weaknesses

Observation 1: There are not clear roles, responsibilities, authorities and accountabilities specified for selected individuals and/or positions. Roles and responsibilities are not spelled out for beamline scientists. While the experimental review process and the role of beamline physicists were adequately explained, the ALS has not documented the process and expectations for beamline physicists from proposal to approval for startup. It may be best to use a block diagram illustrating the roles each party plays for each important step. Howard Hughes beamline staffers are not aware if samples presented to them by users fall within the safety envelope for samples allowed at their beamline; although they felt in most cases it would be obvious.

Interviews indicated that a triumvirate of safety has evolved in ALS consisting of the previous ALS Director, the ALS ESH Coordinator and the Staff Safety Committee. While this construct illustrates safety leadership at many levels, there is currently no clear statement as to who is in charge of safety (including, and preferably, the ALS Division Director).

Observation 2: The EHS Coordinator position in the Nuclear Sciences Division is currently being staffed by the deputy Division Director in an acting capacity. It would appear highly unlikely that the person in that position has the time available to devote to the Coordinator position. Also, it is highly unlikely that the Deputy Division Director's education and background provide him with the knowledge necessary to fulfill this role effectively over a long period of time. The Laboratory has indicated that a search is underway for a replacement who can provide dedicated support.

Observation 3: There appear to be no LBNL requirements for safety training by vendors. Maintenance and repair on the microscopes at the NCEM are performed by vendor service personnel. Because the Laboratory does not ensure vendors meet LBNL requirements (e.g., compliance with NFPA 70E), the possibility exists for non-compliance with DOE requirements and for vendors to perform inadvertent unsafe acts while working on the machines.

Functional Area Opportunities for Improvement

The listed opportunities for improvement for this functional area are initiatives that, in the opinion of the review team, would enhance performance of aspects of the LBNL ISMS.

1. Institute detailed LBNL-wide practices in the areas of accelerator safety order compliance; oxygen deficiency hazard assessment; roles, responsibilities, authorities and accountabilities; vendor safety requirements; and nanoparticle safety. These institutional-level practices should be established with Division-level input.

2. Implement an Unreviewed Safety Issue Program for accelerators.

3. For worker-planned work, document a few cases of pre-job briefings, job-site walkdowns and post-job reviews.

4. For worker-planned work, institute Laboratory-wide boundaries for allowing worker-planned work (e.g., a list of low-hazard jobs with an explanation or description of what the Laboratory considers as low-level hazards).

5. Document the few safety rules that all personnel must follow (or else risk potential disciplinary action). Seek the input of all workers before the final list is adopted by management and then publish the list widely.

6. Determine the level of minimum training needed to be completed by facility users throughout the Laboratory.

7. Establish a system to make sure that all vendors meet the Laboratory's standards for safety training.

8. Where not already in place, institute the practice of utilizing the division safety committee as an input source for division safety practices.

9. Re-orient manager field programs on observation of workers and correcting unsafe behaviors, as opposed to conducting only OSHA, compliance-type inspections. Implement the Hislop program (throughout the Laboratory), or a similar process, that focuses on understanding and correcting worker behaviors.

10. Charter the Molecular Foundry Safety Committee.

11. Document a formal review and formal close-out of all action items for all 88" Cyclotron experiments.

ATTACHMENT 3: BENCH-SCALE RESEARCH AND DEVELOPMENT

Bench-Scale Research and Development Activities

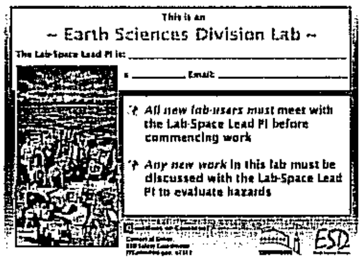
This section focuses on the review of bench-level research and development at LBNL and in UCB-controlled spaces where LBNL work is performed. The observations below are based on walk-throughs of spaces; interviews with staff including management, workers, and support staff; and a review of LBNL and UCB documents.

Core Function 1: Define Scope of Work

Strengths

Observation 1: Several divisions have or are implementing a process to identify hazards at the proposal stage of a project. The ESD has a Proposal Stage Safety Questionnaire (see http://www-esd.lbl.gov/workplace_resources/esd_proposal_center/revisedproposal_init_form_3.doc). The Materials Sciences Division is considering reinstituting a process to identify hazards pre-proposal. In both examples, the hazard questionnaire is/would be reviewed by the Safety Coordinator to help ensure that hazards are properly identified.

Observation 2: At least one Division has a stated expectation that new work in a workspace must be approved by the PI/Laboratory Manager. The ESD establishes an expectation in the Division ISM Plan, and uses a posting (see figure) on the door of each laboratory space, that the scope of work must be communicated to the authorizing authority over a workspace. This best practice is reinforced through postings on the door of each laboratory space.



Weaknesses

Observation 1: Implementation of the Partnership Agreement with UCB does not currently support clear identification of the scope of work for LBNL activities performed in UCB laboratories. The UCB/LBNL Partnership Agreement appears to be well-constructed and feasibly implemented, consistent with the LBNL ISMS. There are examples where similar mechanisms for ensuring the safety of off-site work have been implemented for other DOE Science Laboratories. The Agreement is based on equivalency between the LBNL and UCB EHS programs. The programs have similar hazard assessment/authorization triggers and use similar practices for the control of hazards. However, there is a fundamental issue related to identifying the work that falls under the agreement – it is not currently possible to definitively identify all LBNL work that is being performed in UCB workspaces. Given the volume of work and visibility of the relationship between LBNL and UCB, this is problematic.

Core Function 2: Analyze Hazards; and Core Function 3: Implement Hazard Controls

Strengths

Observation 1: The Safety Coordinator Program is successful. The Safety Coordinators are all hard-working, dedicated to making their managers and staff successful (including safety requirement implementation), and knowledgeable about the LBNL safety program. Most Safety Coordinators have some organizational construct supporting them (e.g., Safety Committee, Safety Wardens) that support safety communication and hazard identification. Safety Coordinators appear to be well aware of ongoing projects and provide a vital connection between laboratory workers and institutional processes.

Observation 2: At least one Division has a process for analyzing all significant hazards of one class of research work and documenting job-specific controls. ESD uses an Off-Site Safety and Environmental Protection Plan (OSSEPP) to address the unique hazards of off-site work (see http://www-esd.lbl.gov/ESDEHS/ossep.html). This is a best practice that provides an excellent example of how the Division has gone beyond PUB-3000 minimum requirements for hazard analysis and work authorization.

Observation 3: At least one Division has implemented operator aids to help staff understand safety expectations using accessible and easily understood formats. ESD uses "Health & Safety – at a Glance" postings (see http://www-esd.lbl.gov/ESDEHS/ataglance_healthsafety.pdf) to communicate important emergency information and safety expectations. This easy-to-read one-page flyer is posted in every laboratory. ESD also places a "Safety Binder" or "Lab Safety Primer" in every workspace, which contains documentation of all of the hazards of that particular laboratory and often contains other information such as expectations of the laboratory-space lead PI and hazard controls particular to the workspace.

Observation 4: There is at least one example where a PI for a rapidly growing project recognized the need for more formality of controls. The PI for the LOASIS project in the Accelerator & Fusion Research Division recognized the need for a formal readiness review to examine hazards and the application of engineered and administrative controls. The readiness review that was conducted was performed as a best practice, as it was not yet of sufficient scale to be required. This effort recognized the linkage between practicing safety and meeting program goals of cost, schedule.

Weaknesses

Observation 1: Documented hazard analysis and work authorization is only performed for high-hazard work. While high-hazard work such as radiological work, work with high-power lasers, and work with highly toxic gases, is typically well-analyzed and authorized through the formal work authorization process, much potentially hazardous work is left to "skill of the craft." Other DOE Science Laboratories have much lower thresholds for documented hazard analysis and authorization of potentially hazardous work (e.g., work with common laboratory chemicals). Furthermore, documented hazard analysis is required by OSHA for some types of work not included in LBNL formal work authorization criteria (e.g., use of PPE). The review team believes that LBNL thresholds for documented hazard analysis and formal work authorization are set too high. Furthermore, the guidance provided for performance of formal hazard analysis is seen as somewhat confusing and potentially not adequate by some EHS support staff, including Safety Coordinators and Safety Liaisons.

Observation 2: PIs and other research and development staff with responsibility for subcontract work (e.g., vendors or specialized off-site work) are not consistently aware of their responsibilities for the safe performance of work by subcontracted workers. LBNL PIs need to be aware of their ultimate responsibility and accountability for safety, even though a subcontractor has been given responsibility for the work (with appropriate contract requirements). In brief interactions with a PI for an off-site project (within ESD) and a discussion with a Physical Biosciences Division scientist responsible for vendor-conducted research and development equipment maintenance, the review team was not convinced that LBNL is providing significant overview of safety matters for subcontracted work. This issue is related to a potential weakness in implementation of Guiding Principle 1 "Line Management Responsibility for Safety" and Guiding Principle 2 "Clear Roles and Responsibilities" by PIs that use subcontractors to accomplish work.

Observation 3: Workers do not appear to be involved in identification and management of hazards as part of many work planning activities (even though staff must read and understand AHDs – there is no mechanism for them to contribute to the final product). There is merely a "read and understand" signature requirement prior to performing work. This misses an opportunity for the organization to benefit from the unique perspective and deep understanding workers often have regarding the work to be performed.

Core Function 4: Perform Work Within Controls

Strength

Observation 1: Several observed workspaces and interviews with staff indicated that work is typically performed well and within established controls. Examples include the Actinide Science group within the Chemical Sciences Division, the Joint Genome Institute, and the Bergman group in the College of Chemistry on the UCB campus.

Weaknesses

Observation 1: There is a significant difference between divisions in the safety culture and discipline of operations that is apparent in the performance of work. Differences were noted in the following:

- Housekeeping in workspaces and maintenance/condition of equipment. There appears to be a lack of understanding regarding the relationship between good housekeeping and safety.
- Degree of engagement and leadership exhibited by the Division Director and PIs in terms of frequency and effectiveness of communication. Some divisions regularly engage PIs in formal reviews of the work they are performing and the hazard control practices being used.

- Assessment processes, including engagement of Division Directors, PIs, Safety Coordinators, and staff in self-assessment. Also, validation that actions are appropriately closed-out is a best practice in ESD. (Note: No one organization is doing all of this, although different organizations are making effective use of various aspects of this approach.)

- Level of detail and effectiveness of organization/facility-specific training.

- Formality of operations as exhibited by clear, documented expectations; frequency, quality, and scope of safety communications; and awareness of and/or concern for all levels of hazard control (not only high hazards documented in PUB-3000, Chapter 6, Appendix B).

While there many examples of effective safety culture and discipline, there were a comparable number of examples where the exhibited safety culture and discipline (as evidenced by poor examples of issues related to the bullets above) had a detrimental effect on safety. There has apparently been no formal attempt to capitalize on the best practices exhibited in some parts of the Laboratory in order to raise the standards and practices in other parts of the Laboratory.

Observation 2: Several instances were witnessed by or reported to the review team when safety requirements were not being rigorously followed – The most obvious examples of safety violations included failure to wear safety glasses when postings or hazardous work activities required it. Other examples included failure to obtain a burn permit for a hand-held torch, obstruction of egress corridors by equipment, and instruments with poorly maintained or worn guarding. While most of the examples observed can be characterized as minor violations, they are behaviors that do not reflect a high regard for safety requirements.

Core Function 5: Feedback and Improvement

Strength

Observation 1: Lessons learned are distributed based on JHQ identification of hazard interactions. This allows the Laboratory to target lessons learned information to an audience that is most likely to benefit from it.

Weaknesses

Observation 1: Many recognized improvement needs have not yet been implemented. Many of the enabling EHS tools that would help management and EHS personnel do their job are still in development.

Observation 2: Assessment is narrowly focused on unsafe conditions and ignores unsafe acts. Activities are not routinely assessed; assessments typically examine only workspace conditions and program deployment.

Observation 3: The CAMS has serious deficiencies. While there appears to be adequate analysis of causal factors for events, there is little evidence of performing extent-of-condition reviews and no evidence of performing effectiveness reviews once corrective actions have been instituted. In most parts of the organization reviewed, there is no process for ensuring assessment findings/actions in CATS are closed out in a timely or effective manner. Safety professionals are not engaged in determining the potential for extent-of-condition issues, which fails to capitalize on their level of knowledge of Laboratory operations.

Observation 4: Communication of lessons learned and deployment to staff needs improvement. In a discussion with a number of Post-Doctorial staff, an example was provided (lessons learned on the "Super Glue" incident), and only six of nine staff recall hearing of the event via management or other Laboratory communications. Other inquiries of staff retention of lessons learned were inconsistent at best.

Guiding Principle 3: Competence Commensurate with Responsibilities

Strengths

Observation 1: EHS staff are highly qualified professionals who are concerned, articulate, and dedicated to the Laboratory's success and their professional ethics.

Observation 2: The JHQ process is rigorously used to drive worker qualification across the Laboratory.

Observation 3: Safety Coordinators get special training for their role. There is a JHQ question regarding whether the person is a Safety Coordinator. The training that a Safety Coordinator receives as a result of his/her job assignment is a selection of other standard LBNL classes. The individual would not necessarily receive this training for any reason other than being a Safety Coordinator. Division Liaisons also receive training tailored to their assignment that they otherwise might not have received.

Observation 4: At least one division provides excellent orientation for new staff. The facility manager for Physical Biosciences Division rigorously controls access to laboratory spaces, documents facility specific training via checklist, and has a communication plan identified for when new hazards are introduced into the workplace. This process is repeatable, documented, and controlled.

Weaknesses

Observation 1: The practice of allowing bench-level workers who have not been trained to LBNL standards to work under the supervision of other (trained) workers does not appear to be implemented consistently or as intended. The review team's concern for this issue intensified as it was discovered that the level of oversight for workers not yet trained and qualified to LBNL standards can be informal and intermittent at best. Note that this observation does NOT intend to imply a lack of competence on the part of untrained/supervised workers or those who supervise them. However, many PIs rely greatly on prior experience of the worker (no matter where obtained) and on the untrained worker to take the initiative to develop their own experimental plans and ask questions about issues – rather than having workers/PIs with responsibility for "direct supervision" of untrained workers proactively guide the untrained workers' activities until they have been introduced to LBNL expectations through formal training and qualification. While most PIs interviewed exhibited strong concern for safety, the informal and infrequent nature of the process by which this already questionable policy is implemented creates serious concerns about "Competence Commensurate with Responsibility." If the practice of allowing untrained workers to perform potentially hazardous work before they complete LBNL training and qualification is allowed to continue, LBNL should clearly articulate expectations regarding "direct supervision" of untrained workers to provide assurance that work is consistently performed in accordance with LBNL requirements.

Guiding Principle 1: Line Management Responsibility for Safety

Strength

Observation 1: Some divisions exhibit excellent culture/practices. While this cannot be said for all divisions (which will be discussed under Weaknesses), some organizations exhibit excellent safety practices from the Division Director, down through PIs to the workers. (Note: As indicated in the Weaknesses under Core Function 1 and below, significant inconsistency was found in leadership and practice, depending on the part of the Laboratory organization.)

Weaknesses

Observation 1: Safety leadership by some PIs is lacking. Although there are pockets of excellent safety leadership by PIs and Division Directors as previously mentioned, there are troubling examples and anecdotes of PIs not providing strong safety leadership. The principle concern is for PIs who do not take ownership of safety for all aspects of their projects and do not exhibit strong and consistent safety leadership to all of the workers (including Post-Doctoral and Graduate Students) on their projects. PIs and other work team leaders have not universally embraced safety as an enduring value.

Observation 2: Management support for the Safety Liaison role is inconsistent. Some Liaisons reported that insufficient time was officially budgeted for the level of support they felt was needed (although most indicated that they spent the time needed to perform the job, and funding was ultimately not an issue). Some of the Liaisons also observed that their annual performance evaluations did not emphasize the Liaison role to the extent they believed was appropriate given the level of effort and importance of the role to the Laboratory. It is not evident to some Liaisons to whom they are accountable.

Guiding Principle 2: Clear Roles and Responsibilities

Weakness

Observation 1: There appears to be very weak accountability mechanisms for Post-Doctoral and Graduate Students. The usual methods used to correct negative behavior (i.e., disciplinary action) appear to be missing. It is understood that unless the PI and the Human Resources organization decide to terminate a Post-Doctoral or Graduate Student, the only threat in the event of improper behavior is to withhold approval of the Post-Doctoral or Graduate Student's thesis, or withhold recommendations for future appointment at other institutions.

Functional Area Opportunities for Improvement

The listed opportunities for improvement for this functional area are initiatives that, in the opinion of the review team, would enhance performance of aspects of the LBNL ISMS.

1. Take advantage of the best practices that have grown/evolved in some of the divisions and institutionalize them as requirements and/or expectations across LBNL. For example:

    - ESD Director practices to demonstrate commitment and leadership;
    - Physical Biosciences Division new employee orientation practices; and
    - Joint Genome Institute hazard and control posting practices.

2. Work with UCB to definitively identify where all LBNL work is being performed and who is performing such work.

3. Reconsider the very high threshold of hazard that is allowed before formal hazard analysis and authorization is required – many lower-level hazards present significant risks that deserve some level of demonstrable analysis and authorization. Develop efficient ways to identify, communicate, and demonstrate control of lower risk/common hazards such as routine use of chemicals, sharps, etc.

4. Improve PI's awareness of – and expectations related to – their ultimate responsibility and accountability for subcontractor safety, even though a subcontractor has been given responsibility for the work (with appropriate contract requirements).

5. Develop and deploy minimum standards and expectations for workers to interact with hazards if they have not been fully qualified (including whether supervised work with certain hazards will be allowed, the level of supervision required, etc.). Develop more efficient mechanisms to train and qualify staff so they can more quickly begin work independently.

6. Consider innovative ways to change the "academic" culture as applied to safety, such as mentoring in the model of physician residency when Post-Doctoral and Graduate Students enter the Laboratory (i.e., demonstrate the proper techniques and then assure that it is being performed properly).

7. Develop a more risk-based approach for prioritization of resources devoted to implementation and improvement of aspects of the ISMS.

ATTACHMENT 4: FACILITIES AND OPERATIONS

This section presents the results of the review of Facilities and Operations at LBNL, concentrating on the activities of the Facilities Division, and including work both on and off the Laboratory site. The observations below are based on walkthroughs of spaces and construction sites, interviews with laboratory and construction contractor staff, and a review of LBNL and UCB documentation.

Core Function 1: Define the Scope of the Work

The definition of work within a facilities management organization is typically distributed among many levels of Laboratory staff, from senior management to individual workers. Well-defined projects are defined at the senior level through the use of an effective prioritization process. In the "mid-range," much work is defined by procedure, consisting primarily of utility operations and preventive maintenance work. Other work is defined by supervisors based on customer requests. Specific tasks to be performed in the field on "trouble calls" must, in most cases, be determined by the craftsperson responding. These functions are operating effectively.

Core Function 2: Analyze Hazards and Core Function 3: Implement Hazard Controls

Strengths

Observation 1: Safety Coordinator, Construction Safety Engineer, and Safety Liaison support is readily available to workers and managers at all levels. All craftspersons, supervisors, and engineers reported easy access to their Safety Coordinator and Liaison, the Construction Safety Engineer and EHS subject matter experts. The Laboratory's decision not to charge back these services enhances the availability. Each of these EHS staff members is highly motivated and thoroughly knowledgeable about LBNL requirements and the Facilities Division's operations. They are viewed as integral members of the Facilities team.

Observation 2: Construction safety is given a high priority. Significant attention has been paid to construction safety. Construction contract specifications include a comprehensive section outlining EHS requirements. Contractors are selected in part based on their OHSA logs (safety performance outside LBNL), and contractor health and safety plans (from the general contractor and their subcontractors) are required to be approved by the Laboratory before work can begin. Specific hazards are managed through a series of permits. A full-time construction safety engineer is assigned to construction projects and actively improves contractor safety. There is evidence of continuous improvement in hazard analysis and controls in the field.

Weaknesses

Observation 1: Accurate, facility-specific hazard data is not readily available to those planning work. The HEAR database does not receive data from the various databases maintained by the Industrial Hygiene Group. Some of the data is out of date by several years. As a result, it is typically not used by Facilities work planners, supervisors, and workers. AHDs also cannot be readily accessed by Facilities staff. Facilities hazards are identified informally by supervisors and workers using "institutional knowledge," room hazard postings, and space occupant knowledge. The latter two are typically accessed only when the worker reports to the jobsite.

Observation 2: Construction safety documentation processes need improvement. Facilities Division procedures require specific types of Contractor Health and Safety Plans based on contract dollar value rather than risk. Managers and engineers report that they (appropriately) use a risk-based criterion. Signed contractor/subcontractor health and safety plans are not kept at the construction site, making it unclear if the most current (approved) versions are being used. These plans, including the activity hazards analysis/hazard abatement plans, are not specific as to the PPE required for construction tasks. Some construction safety documents are being approved by the EHS staff rather than the project managers as required by procedure. An expired penetration (digging) permit was observed at one jobsite. The penetration permit system is very labor intensive considering the short life of the permit.

Core Function 4: Perform the Work Within Controls

Strengths

Observation 1: Managers' work observations and the WOW Program are effective at raising safety awareness. The Facilities Division Director routinely walks through Division facilities and observes work in progress. The WOW program combines the benefits of safety observations, worker involvement in safety, and peer pressure to increase safety awareness and eliminate unsafe behaviors. Craftspersons questioned on requirements for radiation work were very knowledgeable of Laboratory requirements and safe practices.

Observation 2: Financial incentives were used in the Molecular Foundry construction contract. LBNL project management and procurement staff included a financial incentive for excellent safety performance in the construction contract for the Molecular Foundry project.

Weaknesses

Observation 1: A safety system was taken out of service without a formal process. At the offsite scientific computing facility, a safety system had been taken out of service. There was no record made of this system impairment. There was also no formal process in place to assure it was put back in service after completion of the construction activity; this necessitated that it be inactivated.

Observation 2: Construction safety coverage may need to be increased. The Facilities Division has one Construction Safety Engineer assigned to multiple construction projects across the site as well as for projects in offsite facilities. Some supplemental coverage has been arranged on occasion through a consulting contract. In the case of one construction project, contractor safety specialist coverage is limited to two visits per month, making the Laboratory's coverage more critical.

Core Function 5: Feedback and Improvement

Strengths

Observation 1: There is robust, verbal feedback from workers that is used to improve safety. All craft supervisors are receiving frequent, quality feedback from craftspersons while work is ongoing and after work is completed. Several improvements in procedures, PPE, equipment, and other safety aspects have been the direct result of worker feedback. The Division Director and Safety Coordinator also receive valuable input during work observations.

Observation 2: The Plant Maintenance Technician Supervisor has a strong shift-change process. Plant Maintenance Technicians on the incoming shift have an opportunity to meet as a group with the outgoing shift. A detailed checklist is used to convey the status of jobs, equipment, and other pertinent details. The sessions are highly interactive.

Weaknesses

Observation 1: Worker feedback is not collected and documented. While verbal feedback from workers is robust, there is no process to formally collect this information across shops, summarize it and make it available (in the form of lessons learned) to those planning future work within the Facilities Division or other Laboratory organizations engaged in similar activities.

Observation 2: Contractor performance on LBNL projects is not formally collected and used in subsequent contractor evaluation and selection processes. As noted above, contractors are selected based, in part, on their OSHA log. However, the OSHA log is essentially a lagging indicator of safety performance. Contractor and key supplier performance on LBNL projects (safety deficiencies, near misses, etc) would be a powerful leading indicator of potential accidents. This information is not collected, summarized and documented in a performance report for use in subsequent contractor evaluation and selection processes. The current process which relies on informal input from project managers, may not be effective, and may lead to procurement issues.

Guiding Principle 1: Line Management Responsibility for Safety

Strength

Observation 1: Facilities Division Director and supervisors demonstrate care for worker safety. From the Division Director through first line supervision, all managers and supervisors in the Facilities Division are clearly dedicated to keeping their people safe. The Division Director's practice of meeting one-on-one with all new Division employees to discuss safety expectations is a noteworthy practice. Workers and the safety staff supporting the Facilities Division recognize this commitment. The EHS professionals are working hard to provide the support needed to make sure injuries are prevented.

Weakness

Observation 1: EHS staff are approving documentation that should be approved by the line manager. Several process documents, which should be approved by the line managers, are being reviewed and approved by the EHS staff or Safety Coordinator. An example is the Contractor Health and Safety Plans which are approved by the EHS Construction Engineer. These plans are required to be approved by the project manager.

Guiding Principle 3: Competence Commensurate with Responsibility

Strengths

Observation 1: The Laboratory Director is requiring safety training. Given the activity-based structure of the Laboratory's ISMS program and the increased reliance this places on safety awareness at the supervisor level, the Laboratory Director is requiring all supervisors to complete supervisory training by the end of FY07. This training includes a safety component. In addition, the Laboratory is rolling out a causal analysis training program to improve the effectiveness of event and incident management.

Observation 2: Safety training is given high priority in the Facilities Division. As noted above, the Division Director meets with every new Division employee to discuss safety expectations. New Facilities Division supervisors are given an orientation by the Division Safety Coordinator. Minimum common safety training requirements have been established for all craftspersons in the Division. In addition, some crafts supervisors have customized the Laboratory's JHQ and tailored it specifically to the hazards their people will experience in their work. This has improved employee acceptance and use of the JHQ checklist that is printed out with each Work Order. Facilities Division supervisors have scheduled training during their least busy quarter of the fiscal year to assure maximum training accomplishment. Project Managers in the Engineering organization are required to take 10-hour OSHA training. Through the use of work group modules in the Laboratory's training management program, craft supervisors can readily check the training status of their people.

Weaknesses

Observation 1: Hazard identification and controls often fall to workers who may not have sufficient skills in these areas. For jobs determined by supervisors to be skill of the craft jobs, workers are responsible for completing the JHA form. In some shops, supervisors do not review the JHA completed by the worker before the work is finished. The hazard controls being decided by the workers include the PPE requirements for the job. This practice is considered a significant weakness because, as noted earlier, workers and supervisors do not have ready access to accurate facility hazards information, and there is no formal process to validate the hazard recognition skill of the workers.

Observation 2: Workers can work for up to six months under trained supervision without having completed their required training. The Facilities Division handles over 25,000 work evolutions per year. In this environment, the probability that a worker without completed training will be able to be assigned 100% of the time to a fully trained worker is low. Also, even with supervision, lack of completed training still exposes a worker to a higher level of risk of injury.

Observation 3: Contractor employees are not trained in Laboratory-wide hazards. Contractor and vendor employees performing work onsite are not provided with Lab-wide hazards training before commencing work.

Observation 4: Training and qualifications have not been established for positions having facility safety responsibilities. Training and qualifications requirements have not been established for Building Managers across the Laboratory. The Facilities Division Director is ensuring that the Safety Coordinator is receiving appropriate training. The Building Manager program offers an excellent opportunity to augment the Hazards Identification/Hazards Control process, but the lack of training and qualifications standards has led to Building Managers having significantly varying degrees of safety knowledge.

Functional Area Opportunities for Improvement

The listed opportunities for improvement for this functional area are initiatives that, in the opinion of the review team, would enhance performance of aspects of the LBNL ISMS. Several of these opportunities for improvement are included as part of the overall recommendations identified for this review.

1. Make PPE requirements explicit for in-house and subcontractor workers.

2. Tailor Maximo-generated JHA checklists to specific crafts to improve relevancy and encourage use.

3. Streamline the penetration (dig) permit process.

4. Have key EHS documentation formally approved by line management with concurrence by EHS professionals.

5. Accord high priority to the HEAR database upgrades and their implementation; validate hazard data transferred to the system; review and revise as appropriate Laboratory requirements for entering hazard data into HEAR and its "feeder" databases.

6. Post approved and current construction authorization and safety documents at all jobsites.

7. Perform an assessment of the process for operations and maintenance maintainability reviews of engineering drawings and specifications before construction commences (potential staffing concern).

8. Develop a formal process to evaluate and record contractor performance on LBNL projects; maintain contractor performance records and use in future contractor selections.

9. Design a process to ensure that workers are skilled in hazard recognition.

10. Document worker feedback and develop a means to share lessons learned.

11. Perform a management review of the adequacy of safety staffing levels for in-house and construction work.

ATTACHMENT 5: WORKER SAFETY AND HEALTH

This section examines the enabling ISMS functional areas (e.g., radiation protection, industrial hygiene, etc.) and their implementation throughout LBNL activities, including facilities operations, user facilities, and bench-scale research and development. The following observations are based on review of applicable LBNL documents, interviews with LBNL personnel (including Division Directors, SMEs, EHS Liaisons, Division Safety Coordinators, PIs, and Post-Doctoral and Graduate Students), and observations during walkthroughs of LBNL work spaces.

Core Function 1: Define Scope of Work

Strength

Observation 1: The RWA work planning process requirement of a personal interview and proposed work location review between the PI and Health Physicist is a noteworthy practice.

Weaknesses

Observation 2: Workers do not appear to be adequately involved in the work planning process. Inconsistent messages were delivered in interviews with PIs, Post-Doctoral Researchers, and Graduate Students with respect to their understanding of the documented work planning process. The determination that a formal authorization is required is the responsibility of the work leader; however, the work leader does not appear to be directly involved in the development of the formal authorization. Furthermore, workers are responsible for identifying excursions from authorized work boundaries, but are not involved in the process of identifying/establishing these boundaries.

Observation 3: The term "significant change" is not consistently understood when modifications to work authorizations and planning documents are required. PUB-3000, Chapter 6, defines a significant change as any change that results in an increase or decrease in hazard. While procedures state that it is the responsibility of the worker to identify when these modifications are required because of significant change, the worker is not consistently involved in the development of the original documentation and thus is not cognizant of the threshold for document modification. Personnel who were interviewed provided inconsistent understanding of when modifications to work planning documentation are required.

Observation 4: The specific activity thresholds driving increased rigor in work planning (identified in PUB-3000, Chapter 6, Appendix B) appear to permit a significant amount of work and risk acceptance to be performed without formal management planning and involvement.

Observation 5: EHS division authorization of AHDs dilutes line management ownership of responsibility for safety.

Observation 6: Construction projects above a fiscal threshold are subject to a design review and development of a formal Safety and Health Plan. A review team is created, consisting of subject matter experts, including safety and environmental experts who evaluate the project during the planning phase and review of the Safety and Health Plan. In contrast, construction projects below a fiscal threshold are evaluated using a project safety checklist. Personnel interviewed did not consistently articulate this process, instead believing that projects below a fiscal threshold do not receive a formal design review.

Core Function 2: Analyze Hazards, and Core Function 3: Implement Hazard Controls

Strengths

Observation 1: The Division Safety Coordinator plays an instrumental role in hazard identification. Interviewees consistently referred to the inclusion of the Safety Coordinator as a valued and critical element of hazard identification. This is a positive program element.

Observation 2: Enhanced controls for usage of x-ray systems in Building 70A were identified as a noteworthy practice. Activation of x-ray equipment is linked to a user's badge access, and access is only granted following completion of training and x-ray authorization. Additionally, real-time radiation monitoring, with output available at remote locations, provides early identification of potential inadequacies in hazard controls.

Weaknesses

Observation 1: The hazard identification process is expert-based and relies on individual decisions to consult EHS subject matter expertise when necessary and may allow incomplete identification of hazards when required expertise is not sought out. For hazards perceived as high-risk (e.g., radiological, laser), expertise is routinely consulted. For hazards perceived as low-risk (e.g., chemical safety, hoisting/rigging), expertise is not regularly consulted.

Observation 2: Workers do not appear to be effectively and consistently involved in the hazard identification process. AHDs reviewed were developed by PIs or Division Safety Coordinators and do not provide a complete identification of hazards (particularly workplace-specific hazards). For example, one AHD referred to mixing equipment, but made no identification of rotational/mechanical hazards associated with the equipment (Fixed Treatment Plant). Increased involvement of worker involvement may result in more complete identification of workplace hazards.

Observation 3: Work scopes falling below the level of a formal work authorization do not receive a thorough hazard analysis and mitigation where there are multiple interacting hazards. Interviewees commonly referred to worker expertise and educational background as informal and necessary mechanisms for identifying hazards. In particular, chemical hazards are not clearly communicated, and worker expertise in chemical knowledge is cited as the means to identify hazards associated with chemical usage. Additionally, division-level documentation is utilized for line-management authorized work, but does not include identification of workplace-specific hazards.

Observation 4: Identification and application of hazard controls is not consistent with the hazards identified. Eye protection requirements varied among laboratory spaces with similar hazards (e.g., safety glasses not required in Life Sciences laboratory despite use of acids in laboratory processes, use of safety glasses inconsistent in Physical Biosciences laboratory [eye protection not required for personnel working adjacent to neighboring laboratory processes using chemicals]). Apparent evidence of lagging inspection of ventilation hoods was seen. Stickers affixed to ventilation hoods incorrectly identified the inspection periodicity and/or the date of the last inspection. Although an electronic record is maintained as the "official" inspection inventory, one could infer that the physical information attached to the ventilation hood is the source that most laboratory personnel would refer to in determining whether the engineering controls are effectively mitigating area hazards. Consumption of food and beverage in laboratory spaces using hazardous chemicals was observed (e.g., food and beverage observed in the Life Sciences laboratory outside of areas designated as "clean" areas, some confusion about interpretation in Physical Biosciences laboratory). Controls associated with crane operations are not applied as identified in PUB-3000.

Core Function 4: Perform Work Within Controls

Weaknesses

Observation 1: There are indications management may be passively condoning violation of existing laboratory-level procedures by ignoring or not enforcing existing requirements. For example, it is an accepted practice in the Building 77 shop areas that crane operations involve the movement of loads directly over personnel work areas, and those personnel are not required to wear protective equipment (e.g., hard hats). This practice is in violation of PUB-3000, Section 5.4.5.5, Suspended Loads. While loaded crane operations were not directly observed during the assessment, personnel interviewed indicated that hard hats are not required in the area during such operations. Additionally, evidence of food and beverage consumption was observed in laboratory spaces where chemicals are is use (including laboratory spaces in Building 84 outside of areas designated as "clean" areas). When questioned, feedback from multiple interviewees indicated that it was permissible to eat or drink as long as it was not on the bench top, or that is was permissible to drink if the container had a closed lid. However, the Chemical Safety and Hygiene Plan states "Do not smoke, chew gum, apply cosmetics, or consume food and beverages in areas where hazardous materials are being handled." In multiple facilities, (1) the offices, laboratory spaces and bench tops are extremely cluttered; (2) food/drink is present in laboratories containing chemicals; (3) equipment, bicycles, etc. are stored in egress hallways; (4) electrical panels are blocked; (5) fluorescent lights are leaning against walls; (6) a broom was perched precariously over doorway and work area; and (7) a fire extinguisher was sitting in hallway floor (not hung up). These ongoing poor housekeeping/fire safety practices are in violation of PUB-3000, Section 5.6, OSHA Compliance.

Observation 2: A clear authorization to commence activities does not exist for line management authorized work. In one specific instance, where an experiment was modified to use a new chemical, operations commenced and were then later halted when the work leader learned of the new chemical in use and the inappropriateness of its usage.

Observation 3: Personnel appear to understand their responsibility and authority to stop (suspend and re-consider) work in unsafe situations that present less than imminent risks. However, PUB-3000, Chapter 1 defines this responsibility for situations considered to be an imminent danger where it could reasonably be expected to cause death or serious injury, or environmental harm. It does not reflect worker responsibilities to limit work activities when the unsafe situation is less than at an imminent level.

Observation 4: There does not appear to be an institutional process to identify and control out-of-service equipment. For example, AHDs are developed for laser use. At the end of an experiment using a laser, an AHD would be retired; however, the laser would remain in the laboratory space and could be used (and pose area hazards) without re-entering the work authorization (and AHD development) process.

Core Function 5: Feedback and Improvement

Strengths

Observation 1: The Engineering Division is proactively communicating the concepts of ISM to Division personnel. Division leadership has designed an ISM card for each employee that communicates ISM concepts in simple language that can be applied in daily work settings.

Observation 2: A significant number of safety inspections are performed throughout laboratory operations. They are most commonly performed by the Division Safety Coordinators. Identified issues are entered into CATS, are assigned to responsible individuals, and are tracked to closure. Recently, a training class focused on walk-around training capabilities is being offered.

Weaknesses

Observation 1: Although there appear to be multiple safety walkthroughs in most divisions, as a rule the worker is not directly involved in performing these inspections and there is little to no trending of the data obtained from the inspection. Feedback to the affected staff appears to be inconsistent.

Observation 2: Some staff interviewed indicated a few instances of avoiding the perceived repercussions of reporting incidents and lower-level (first aid) injuries by not reporting. Awareness of upcoming reviews and audits sometimes results in behavior that is not intended. The ban on "Super Glue" was cited as an example; staff have hidden the product and continue to use it. It is not known how widespread these practices are at the Laboratory.

Observation 3: It does not appear that divisions commonly develop local expectations differing from the EHS-developed expectations. The Office of Contract Assurance develops a set of expectations that are assessed by each Division annually. While this process collects data for use by the EHS Division, it is not clear how assessment findings are utilized by other divisions. The EHS Division Director noted these criteria tend to look at lagging indicators and that more attention needs to be paid to preventing and analyzing recurrence issues.

Observation 4: Division self-assessments appear to be limited to safety inspections and responses to EHS expectations.

Guiding Principle 3: Competence Commensurate with Responsibilities

Strengths

Observation 1: A broad cross-section of training is offered to qualify personnel. Interviewees consistently referred to Laboratory-level training as the initial source of safety awareness, followed by job-specific training as a means for ensuring workplace safety. In several divisions, scientific staff are assigned to mentors who provide on-the-job training until individuals are deemed proficient. While formal documentation of worker proficiency varies, it appears that the staff are not permitted to work unsupervised without sufficient qualifications.

Weaknesses

Observation 1: Worker awareness of perceived low-risk hazards is expert-based and such hazards are not formally analyzed. Interviewees consistently referred to their educational knowledge and experience as a primary resource for ensuring workplace safety with respect to perceived low-risk hazards (e.g., chemical safety). Although workers complete a JHQ that identifies required formal training requirements, it does not address area-specific hazard training requirements.

Observation 2: Division Safety Coordinators are not consistently assigned based on prior safety management experience. Without prior experiences, a Safety Coordinator may not be skilled at identifying situations where outside expertise should be consulted.

Functional Area Opportunities for Improvement

The listed opportunities for improvement for this functional area are initiatives that, in the opinion of the review team, would enhance performance of aspects of the LBNL ISMS. .

1. Consider the value of performing program maturity evaluations on a frequent (recommended annual) basis. The evaluation should be designed to give the program owner results for the areas that need improvement and should be focused on improving the program's integration with other systems and into Laboratory, facility, and bench-level activities.

2. Increase worker involvement in work planning, including revising procedures to assign more responsibilities to the workers.

3. Ensure AHDs and other key documents are authorized by line management with EHS concurrence.

4. Re-evaluate the formal work authorization thresholds to consider increasing the scope of projects reviewed through the formal work authorization process.

5. Review application of hazard controls for adequacy – promote consistent and complete compliance with controls (PPE) identified in lab procedures.

6. Encourage divisions to develop individual self-assessment criteria aimed at division-specific issues and self-assess against those criteria regularly.

7. Consider expanding safety walk-arounds to promote increased worker involvement. Consider exchanging safety walk-around personnel between divisions to allow for a fresh perspective into potential safety issues.

ATTACHMENT 6: WASTE MANAGEMENT AND ENVIRONMENTAL PROTECTION

This section examines the LBNL Waste Management and Environmental programs and their implementation throughout LBNL activities. The following observations are based on review of applicable LBNL documents, interviews with LBNL personnel (including Division Directors, subject matter experts, EHS Liaisons, Division Safety Coordinators, PIs, and Post-Doctoral and Graduate Students), and observations during walkthroughs of LBNL work spaces.

Core Function 1: Define Scope of Work

Strength

Observation 1: Potential hazardous waste-generating activities are commonly identified early in the work planning process. Waste Generation Assistants within the EHS Division are assigned to assist each of the divisions generating hazardous waste and provide assistance in the work planning process when solicited.

Weakness

Observation 1: Identification of environmental protection issues in work planning is expert-based. The effective identification of environmental protection issues is dependant on the familiarization of EHS Liaisons for formal authorizations and Division Safety Coordinators for line management authorizations. Inclusion of environmental expertise is not automatic.

Core Function 2: Analyze Hazards, and Core Function 3: Implement Hazard Controls

Weaknesses

Observation 1: Identification of environmental protection issues in work planning is expert-based. The effective identification of environmental protection issues is dependant on the familiarization of EHS Liaisons for formal authorizations and Division Safety Coordinators for line management authorizations. Inclusion of environmental expertise is not automatic. It does not appear that workers commonly associate environmental protection with the ISMS process.

Observation 2: A master inventory of SAAs does not exist. Procedures document a requirement to limit storage of hazardous wastes in SAAs to 9 months; however, without a complete inventory, compliance cannot be assured.

Core Function 4: Perform Work Within Controls

Strength

Observation 1: The hazardous waste management program appears to be an effective and valued program at all levels. Users consistently complimented the services provided by hazardous waste collection/management staff. Operations at the hazardous waste management facility appeared to be well-organized, controlled, and documented.

Core Function 5: Feedback and Improvement

Strengths

Observation 1: The EMS undergoes an annual assessment conducted by the Office of Contract Assurance. Additionally, an external assessment is conducted every three years to verify the findings of the internal assessments. These assessments assist the Division in developing Laboratory expectations, which are reviewed annually. An annual Management Review of the EMS program is also conducted, which is a valuable tool for enhancing program visibility and resource needs.

Observation 2: Identification of waste-minimization opportunities is included in the Division feedback from their annual assessment of EHS expectations. One PI commented that the waste minimization mindset of today's students is significantly improved over that of previous generations.

Guiding Principle 3: Competence Commensurate with Responsibilities

Weakness

Observation 1: Division Safety Coordinators and EHS Liaisons are not consistently assigned based on prior environmental protection experience. Safety Coordinators and EHS Liaisons may not consistently be skilled at identifying situations where environmental expertise should be consulted.

Functional Area Opportunities for Improvement

The listed opportunities for improvement for this functional area are initiatives that, in the opinion of the review team, would enhance performance of aspects of the LBNL ISMS.

1. Incorporate environmental protection personnel into the planning process or provide additional environmental protection cross-training to those in the planning process.

2. Reconsider the value of developing in-house EMS program criteria versus ISO 14001 program criteria. Whichever path is chosen, the EMS should be designed to help improve environmental performance, assure compliance with legal and other requirements, improve effectiveness and efficiency, reduce costs, and earn and retain regulator and community trust.

ATTACHMENT 7: LIST OF DOCUMENTS REVIEWED

The Laboratory established a web site (Share Point Site - http://www.lbl.gov/ehs/ism/external-audit/index.shtml) with numerous documents organized in the following areas:

- Overarching Plans
- Research and Development Experimental Planning and Execution
- Maintenance and Operations Activities
- Performance Management
- Worker Safety and Health
- Waste Management/Environmental Protection
- Training and Qualifications

The documents indicated below are those that were of particular interest to the review team:

DOE Independent Validation Team Review of Lawrence Berkeley National Laboratory Corrective Action Plan, August 2006

DOE Order 226.1, Implementation of Department of Energy Oversight Policy, September 15, 2005

DOE Manual 226.1-1, DOE Safety Oversight Manual, Draft

Earth Sciences Division Integrated Safety Management Plan, Revision 6, February 2005

Earth Sciences Division Off-Site Safety and Environmental Protection Plan (template)

Earth Sciences Division Lab Safety Primer (template)

Engineering Division FY2006 Self-Assessment Report

Environmental Aspects/Impacts Inventory and Significance Determination

EHS Directorate Management Review Minutes

Environmental Management System Internal/External Assessments

Ernest Orlando Lawrence Berkeley National Laboratory, Environment, Safety and Health Self-Assessment Program, LBNL/PUB-5344 Revision 3, February 2002

Health and Safety Manual, LBNL/PUB-3000, March 2006

Integrated Environment, Health & Safety Management Plan, Integrated Safety Management (ISM) System, LBNL/PUB-3140, September 2005

Lawrence Berkeley Laboratory Integrated Safety Management Peer Review, UCLR-AR-218787, February 10, 2006

Lawrence Berkeley National Laboratory 2006 Functional Appraisal Template

LBNL ES&H Corrective Action Plan, June 1, 2006

Matrixed Employee Memorandum of Understanding

Memorandum: David C. McGraw to Distribution; Subject – Work Smart Standards Update Process, April 2, 2001

Memorandum: Howard Hatayama to AFRD, ALS, CSD, ESD, BH, LSD, MSD, NSD, and PBD Divisions Directions; Subject – Laser Safety Assurances for DOE Berkeley Site Office (BSO), May 25, 2006

Operating and Assurance Plan for Ernest Orlando Lawrence Berkeley National Laboratory, April 2000

Physical Biosciences Division Integrated Safety Management Plan, May 31, 2006

Physical Biosciences Division Personal Safety Checklist (template)

Physics Biosciences Division Tri-Annual Report

Regulations and Procedures Manual, LBNL/PUB-201

Report on Assurance and Governance for the LBNL, Longenecker & Associates, September 2004

UC Assurance Plan for Lawrence Berkeley National Laboratory, October 2005

ATTACHMENT 8: LIST OF INTERVIEWEES[2]

	Interviewee	Organization
1.	Paul Adams	Physical Biosciences Division
2.	Mark Alper	Materials Sciences Division Deputy Division Director
3.	Stephanie Barnard	Earth Sciences Division
4.	Don Beaton	Facilities Construction Manager
5.	Ali Belkacem	Chemical Sciences Division PI
6.	Robert Bergman	UC Berkeley College of Chemistry/ LBNL Chemical Sciences Division
7.	Bob Berninzoni	O&M Manager
8.	Paul Blodgett	EHS Industrial Hygiene
9.	Gudmundur Bodvarsson	Earth Sciences Division Director
10.	Corwin Booth	CSD PI
11.	Jerome Bucher	Chemical Sciences Safety Coordinator
12.	Doyle Byford	Nuclear Science Division, matrix from Engineering Division
13.	Earl Carnes	DOE Office of Health, Safety and Security
14.	Tom Caronna	EHS Liaison
15.	Jamie Cate	Physical Biosciences Division
16.	Christine Celata	Accelerator and Fusion Research Safety Coordinator
17.	Feng Chen	Genomics Division PI
18.	John Chernowski	Office of Institutional Assurance
19.	Roger Christensen	DOE Pacific Northwest Site Office
20.	Dave Coke	UC Berkeley College of Physics, student
21.	Dennis Collins	Nuclear Science Division, matrix from Engineering Division
22.	Rob Connelly	EHS Liaison
23.	Roy Copping	Chemical Sciences Division
24.	David Costell	Radiation Protection Health Physicist
25.	Mike Crofoot	Carpenter
26.	Zachary Crouse	Owner Crouse Construction
27.	Rainer Daehn	Chemical Sciences Division
28.	Richard DeBusk	EHS Occupational Safety Group Leader
29.	Brandon DeFrancisi	UC Berkeley EH&S
30.	Abby Dernburg	Life Sciences Division PI
31.	Christine Donahue	EHS Radiation Program Group Leader
32.	Mike Dong	Facilities Chief Engineer
33.	Tim Doolin	Nuclear Science Division, matrix from Engineering Division
34.	Sarah Eary	Procurement Manager
35.	Kathy Eidson	Electrician
36.	Paul Fallon	Nuclear Science Division Director
37.	Jeff Fernandez	Chief Financial Officer
38.	Ross Fisher	WSS Lead
39.	Stephen Franaszek	JGI Safety Officer
40.	Heinz Frei	Physical Biosciences Division PI
41.	Mark Freiberg	UC Berkeley EH&S

[2] Unless otherwise indicated, all personnel are from LBNL

	Interviewee	Organization
42.	Michelle Galloway	Nuclear Science Division
43.	Jill Geller	Earth Sciences Division Safety Coordinator
44.	Keith Gershin	EHS Liaison
45.	Joe Gray	Life and Environmental Sciences ALD
46.	Michael Gribble	UC Berkeley College of Chemistry
47.	Eugene Haller	Material Sciences Division PI
48.	Derrol Hammer	Procurement Division Head
49.	Miranda Harmon-Smith	JGF – Production
50.	Courtney Hastings	UCB College of Chemistry
51.	Howard Hatayama	Division Director, Environment, Health and Safety
52.	Jack Heffernan	Facilities Project Manager
53.	Frances Hellman	UCB College of Physics/ LBNL Materials Sciences Division
54.	Amara Holder	Environmental Energy Technologies Division
55.	John Hutchings	Computing Sciences Safety Coordinator
56.	Mike Johnson	Nuclear Science Division
57.	Matt Katowski	EHS Liaison
58.	Guy Kelley	Environmental Energy Technologies Division Safety Coordinator
59.	Rick Kelly	Material Sciences Division Safety Coordinator
60.	John Kerr	EETD PI
61.	Bruce King	EHS Liaison
62.	Michael King	Accelerator and Fusion Research Division
63.	Gudrun Kleist	Nuclear Science Division, matrix from Engineering Division
64.	Timothy Kneafsey	ESD PI
65.	Mike Kritscher	Mechanical Safety Committee Chairman
66.	Paul Kruger	DOE Pacific Northwest Site Office
67.	Jim Krupnick	Office of Institutional Assurance
68.	Mike Kumf	UCB College of Chemistry EH&S
69.	Bill Lau	Nuclear Science Division, matrix from Engineering Division
70.	I-Yang Lee	Nuclear Science Division
71.	Wim Leemans	A&FRD PI
72.	Daniela Leitner	Nuclear Science Division
73.	Kevin Lesko	Nuclear Science Division
74.	Peter Lichty	Occupational Medicine
75.	Anthony Linard	Life Sciences Division Safety Coordinator
76.	Rao Linfeng	Chemical Sciences Division
77.	Carl Lionberger	Nuclear Science Division, matrix from Engineering Division
78.	David Littlejohn	Environmental Energy Technologies Division
79.	Doug Lockhart	Facilities Division Asst to the Director
80.	Tim Loew	Nuclear Science Division, matrix from Engineering Division
81.	Wayne W. Lukens, Jr.	CSD PI
82.	Claude Lyneis	Nuclear Science Division Cyclotron Program Head
83.	Betsy MacGowan	EHS Liaison
84.	Ron Madaran	Physics Division Safety Coordinator
85.	Ernest Majer	ESD PI and Deputy Division Director
86.	Phillip Maynard	UC Berkeley EH&S
87.	David McGraw	Chief Operating Officer

	Interviewee	Organization
88.	Lawrence McLouth	EHS Laser Safety Program Manager
89.	Peggy McMahon	Nuclear Science Division
90.	Dave McPherson	Painters Supervisor
91.	Jim Morel	Nuclear Science Division
92.	Bob Mueller	Electrical Safety Committee Chairman
93.	Aindrila Mukhopadhyay	PBD Scientist
94.	Jim Murphy	Electricians Supervisor
95.	Annica Nilsson	Environmental Energy Technologies Division
96.	Jerry O'Hearn	Department Head Planning, Design and Construction
97.	Dmitriy Panasenko	Accelerator and Fusion Research Division
98.	John Patterson	Facilities Project Manager
99.	Ron Pauer	EHS Environmental Services Group Leader
100.	Jeffrey Pelton	PBD PI
101.	Len Pennacchio	JGI - Genomics
102.	Tom Perry	Nuclear Science Division, matrix from Engineering Division
103.	Evangeline C (Vangie) Peterson	Physical Biosciences Division Facility Manager
104.	Steve Peterson	UCB College of Chemistry EH&S
105.	Ted Pietrok	DOE Pacific Northwest Site Office
106.	Chris Redding	Engineering Division Fixed Treatment Plant
107.	Elizabeth Reyes	DIR/OPS Safety Coordinator
108.	George Reyes	Facilities Division Director
109.	Matt Rice	Toolcrib Attendant
110.	Rebecca Rishell	Life Sciences Division Deputy Director
111.	Ken Robinson	Division Director, Engineering
112.	David Rodgers	EHS Liaison
113.	Ingrid Castro Rodriguez	Chemical Sciences Division
114.	Nancy Rothermich	EHS Waste Management Group Leader
115.	Safety Review Committee	
116.	Jack Salazar	EHS Liaison
117.	Nick Sauter	Physical Biosciences Division Safety Coordinator
118.	David Schild	Life Sciences Division
119.	Robert Schoenlein	Material Sciences Division
120.	John Seabury	EHS Liaison
121.	Janice Sexson	Facilities Safety Coordinator
122.	Bob Shannon	Nuclear Science Division, matrix from Engineering Division
123.	Stuart Smith	UCB College of Chemistry
124.	Pat Thomas	Accelerator and Fusion Research Safety Coordinator
125.	Damon Todd	Nuclear Science Division
126.	Kevin Trigales	Rigger Supervisor
127.	Jeff Trigg	Nuclear Science Division, matrix from Engineering Division
128.	John Tulley	Carpenter Supervisor
129.	Barbara Tuse	EHS Liaison
130.	Linnea Wahl	EHS Liaison
131.	Steve Warner	Nuclear Science Division, matrix from Engineering Division
132.	Modie Wetzler	Physical Biosciences Division
133.	Marty White	EHS Liaison
134.	Becca Wilson	UCB College of Chemistry

	Interviewee	Organization
135.	Weyland Wong	Engineering Division Safety Coordinator
136.	Lyle Woods	Oakland Computing Facility Subcontractor
137.	Li Yang	Earth Sciences Division

ATTACHMENT 9: REVIEW TEAM

Mr. Robert McCallum – Team Leader, McCallum-Turner, Inc.
- Institutional Processes
- Line Responsibility and Accountability

Dr. Kyle Turner – Deputy Team Leader, McCallum-Turner, Inc.
- Institutional Processes
- Line Responsibility and Accountability

Mr. David Allen – Oak Ridge Operations Office
- BSO Activities

Mr. Michael Bebon – Brookhaven National Laboratory
- Facilities and Operations Activities

Mr. Steve Coleman – Brookhaven National Laboratory
- Worker Safety and Health
- Waste Management/Environmental Protection

Mr. Chris Johnson – Brookhaven National Laboratory
- Facilities and Operations Activities

Mr. Lawrence Kelly – Oak Ridge Operations Office
- BSO Activities

Mr. Edward Lessard – Brookhaven National Laboratory
- Large Scale Science Activities

Mr. Larry McClellan – Pacific Northwest National Laboratory
- Bench Scale Research and Development Activities

Mr. Thomas Mullen – Argonne National Laboratory
- Large Scale Science Activities

Mr. Douglas Schlagel - McCallum-Turner, Inc.
- Worker Safety and Health
- Waste Management/Environmental Protection

Ms. Carol Scott – Oak Ridge National Laboratory
- Worker Safety and Health
- Waste Management/Environmental Protection

Mr. Patrick Wright – Pacific Northwest National Laboratory
- Bench-Scale Research and Development Activities