Lawrence Berkeley National Laboratory

Integrated Safety Management (ISM) Plan at the ALS

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TABLE OF CONTENTS

Page

LIST OF ABBREVIATIONS

AHD	Activity Hazard Document
ASE	Accelerator Safety Envelope
BRC	Beamline Review Committee
CSEE	Center for Science and Engineering Education
ESS	Experiment Safety Sheet
GERT	General Employee Radiation Training
ISM	Integrated Safety Management
JHA	Job Hazard Analysis
JHQ	Job Hazard Questionnaire
MESH	Management of Environment, Safety, and Health Assessment
MOU	Memorandum of Understanding
PRD	Performance review document
PRT	Participating research team
QUEST	Quality ES&H Self-Assessment Teamwork
RSS	Radiation Safety System
RWA	Radiological Work Authorization
SAA	Satellite Accumulation Area
SAD	Safety Analysis Document
TSC	Technical Safety Committee

REVISION LOG

Date	Major/Minor	Brief Description of Revision
December 2008	Minor	• Revised Figure 2 (Facility Safety Functions) to reduce confusion with Figure 1 (ISM Organization Chart). • Added more language in on-the-job-training for Users to make current status more clear • Listed specific institutional ISM requirements identified by reference in section 8.
September 2008	Minor	• Updated organization charts. • Updated JHA information. • Added Section 7 Accountability. • Added Section 8 Reference to Institutional ISM.
May 2012	Minor	• General update of information including org charts, deletion of resources, inclusion of more work planning tools, affiliates, SAD/ASE requirements description, etc. • Added Working Alone Policy.

1.0 INTRODUCTION

Integrated Safety Management (ISM) constitutes one of the core premises for the organization and operation of the Advanced Light Source. The ALS has integrated each of the five functions and seven principles of ISM from the institutional LBNL Integrated Safety Plan into its on-going management of the facility. The five functions are: (1) Define the scope of work; (2) Identify the hazards of the work; (3) Develop and implement controls for the hazards; (4) Perform the work as authorized; and (5) Maintain continuous improvement from regular feedback. These five ISM core functions are sustained by applying the seven guiding principles of the ISM: (1) Line management responsibility and accountability for ES&H; (2) Clear ES&H roles and responsibilities for managers and staff; (3) Competency commensurate with responsibilities; (4) An on-going balance between safety on one hand and research and operational priorities on the other; (5) Working within standards and requirements; (6) Hazard controls tailored to the work; and (7) Authorization basis established for the work.

The articulation of this responsibility begins with the ALS Mission Statement: 'Support users in doing outstanding science in a safe environment.'

As a national user facility, the basic premise is to provide scientific service, so all of its functions are organized along service lines. As the last part of the mission statement makes clear, these services are all organized within the constraint of being performed safely. This is understood to be part of management's stewardship responsibilities for a national user facility.

As a large user facility, the organization and implementation of integrated safety management is relatively larger and more complex when compared to other research divisions at Berkeley Lab (LBNL). The purpose of this plan is to describe this logic and implementation.

2.0 LINE MANAGEMENT RESPONSIBILITY

Clear delineation of line management responsibility for safety is critical at the ALS. Characteristics that make this especially challenging for the ALS are:

- Over 50% of the staff who routinely work at the ALS are matrixed from other divisions
- In addition to ALS, four different divisions operate beamlines at the facility
- Each year 2000+ users conduct research at the ALS

An outline of the organization chart is shown in Figure 1 below. Note that a significant part of the ALS organization is comprised of staff from AFRD and Engineering. Because of their significance, they are incorporated directly into the line management of the ALS at the Division Deputy level. In addition to ensuring integration of technical and strategic goals between the divisions, this also ensures coherence of safety responsibilities. Examples of this integration include the implementation of the ALS interlock program (Engineering and ALS), the ALS Safety Analysis Document (AFRD and ALS), and the Beamline Review Committee (Engineering, AFRD, and ALS). At a more detailed level, Memoranda of Understanding (MOUs) have been signed by the respective division directors that address specific responsibilities for staff safety at the ALS.

Formal MOUs have also been established with each of the beamlines operated by other entities. General safety responsibilities between the ALS and individual participating research teams (PRTs) are identified and agreed upon through this process. In order to ensure continuing integration, these PRTs are considered to have a 'dotted line' to the Deputy Division Director for safety oversight.

Line management safety responsibilities for the ALS users are implemented through individual Experiment Safety Sheets (ESS). The ESS describes the standard functions of ISM with signature blocks indicating respective responsibilities of both the user and the ALS staff. All users at the ALS utilize some form of the ESS process. The Beamline Scientists, as hosts, are considered to be the line management for users with respect to safety. Table 1 presents a more thorough description of the relative roles and responsibilities between users and beamline scientists. It should be noted that because users may work at many different beamlines in a year, sometimes simultaneously, the formal Human Resources designation of Supervisor is not useful in describing this responsibility.

Safety line management for ALS staff follows standard LBNL practices flowing from the Division Director to his direct reports and from them, down to first line supervisors. In cases where formal authorizations are required, work leads are clearly identified for individual scope of work. Safety accountability is implemented through standard PUB-3000 methods, and ALS has instituted language in its annual performance review documents (PRDs) to ensure accountability.

Figure 1: ALS Organization Chart

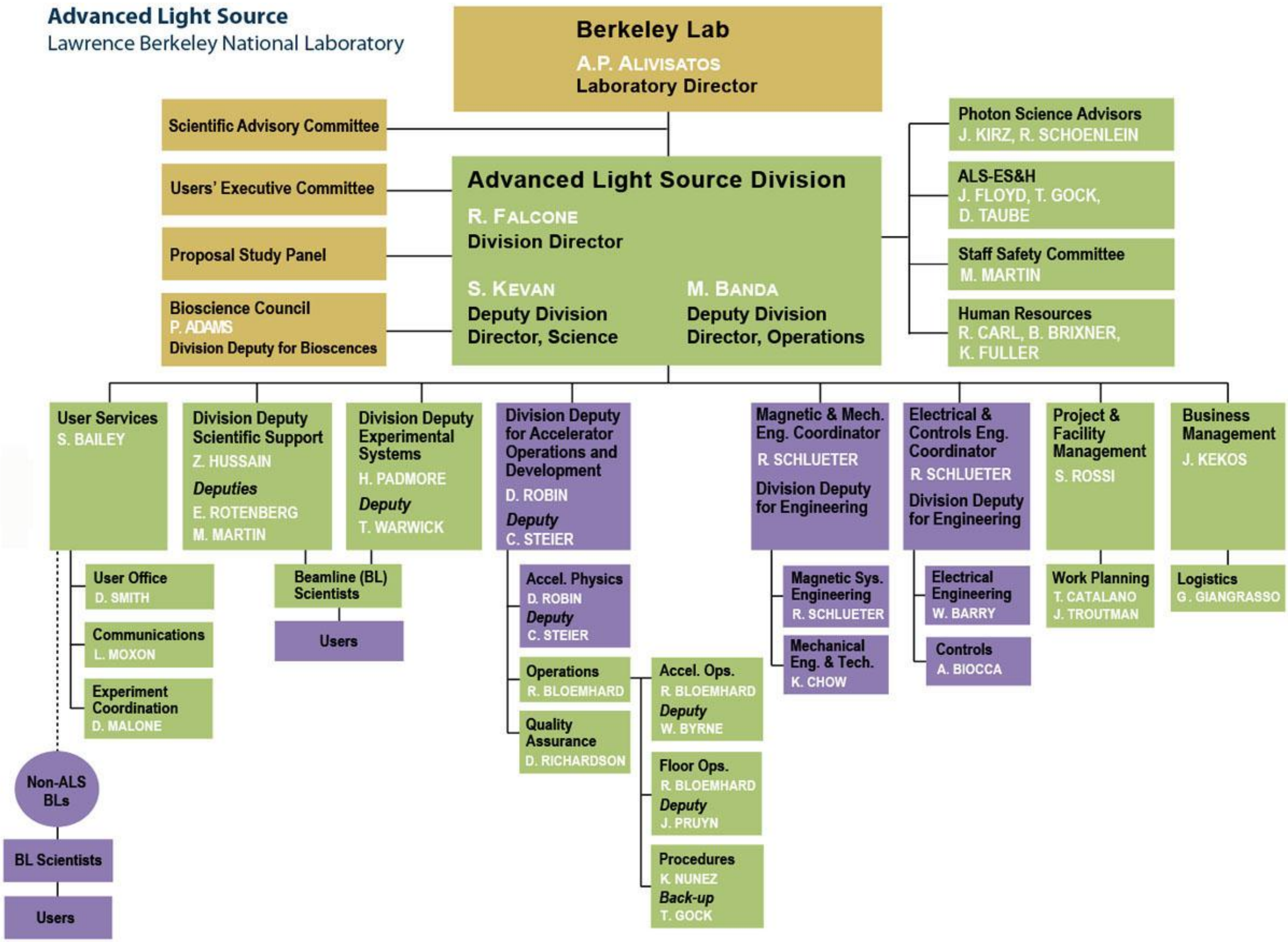


Table 1. Roles and Responsibilities for Users and Beamline Scientists

BEAMLINE SCIENTISTIS
• **Ultimate responsibility for safety at the beamline.** • **Assure that:**
➢ Users submit proper information and that work has been reviewed. ➢ Users are qualified to perform work. ➢ Proper support and oversight is approved.
EXPERIMENTERS-IN-CHARGE
• **Responsibility for safety of the experiment.** • Assure that: ➢ Information submitted about the work and hazards is accurate. ➢ All Users on the team understand and follow the requirements. ➢ Be present or designate an alternate to respond to safety issues.
USERS
• **Personal responsibility for safe conduct of work on an experiment.**

3.0 SAFETY ORGANIZATION

To implement ISM, the ALS devotes a significant part of the organization to safety. Many different organizational units and their staff have explicit safety responsibilities. These consist of both committees and operational functions. Figure 2 shows the organization of these functions. Also included in that chart are the individuals from the EH&S division who provide significant, though independent, support to the ALS.

In addition, a significant part of Accelerator Operations, Electronic Installation, and Mechanical Engineering units perform important safety functions as part of experiment and beamline reviews as well as accelerator operations.

Important Committees include:

- Division Safety Committee
- Beamline Review Committee (BRC)
- Staff Safety Committee

The charter for the Division Safety Committee (chaired by the Deputy Division Director) is to provide an on-going forum for communicating safety issues and status. It contains members from each organizational unit in ALS including Engineering and AFRD functions. These members also chair individual unit safety circles each month so that all staff are apprised of safety issues and status and can bring issues up for discussion on a regular basis.

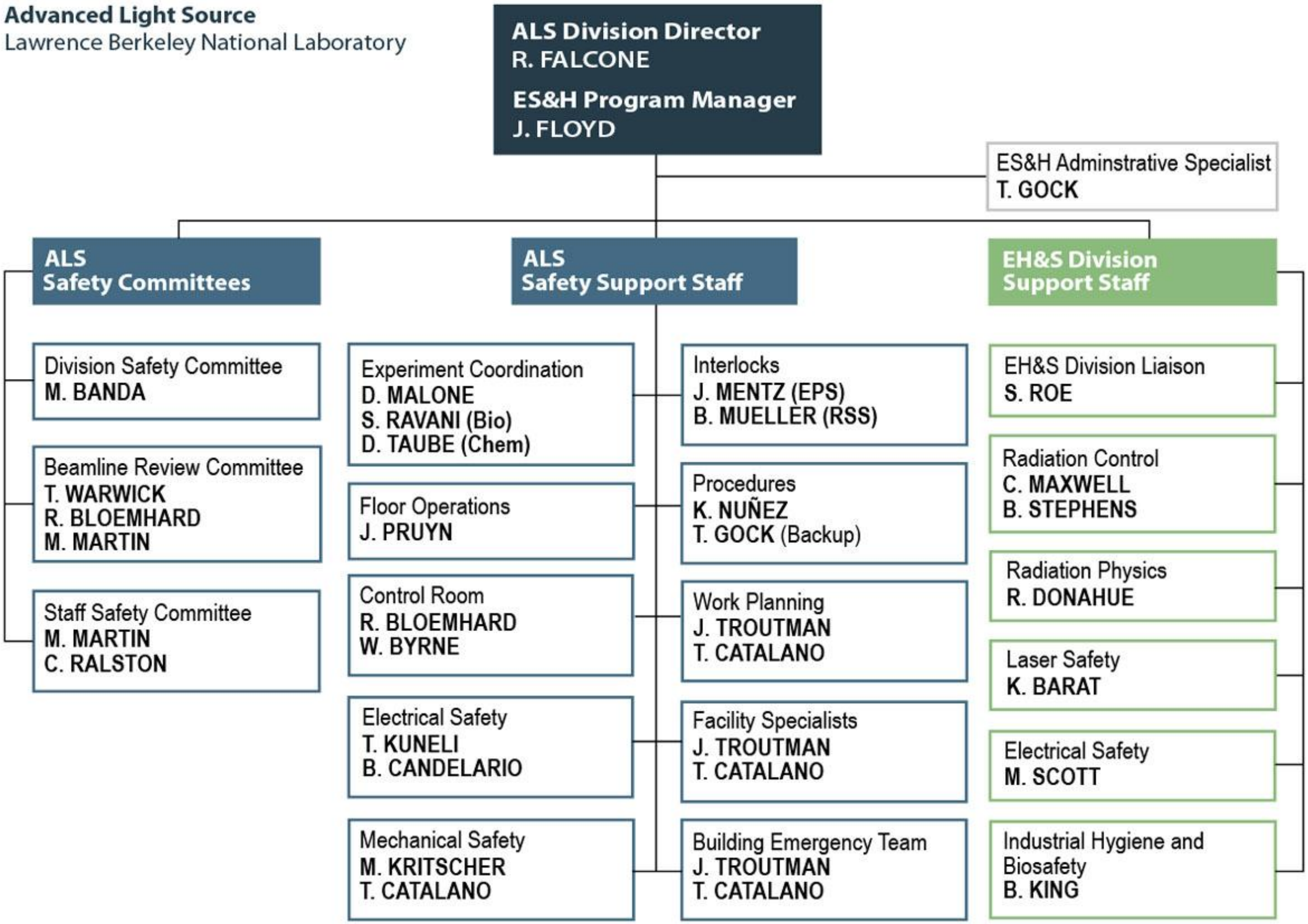
The BRC provides a mechanism to evaluate proposed new beamlines or modifications to existing beamlines to ensure that all technical and safety considerations are addressed before operation. Its processes are organized along project management principles with a conceptual design review, a beamline design review, and a beamline readiness review and walkthrough. This process is discussed in more detail in later sections. It has 17designated members from selected disciplines and several ex-officio members, comprising several different divisions. For smaller projects, there is also an abbreviated process that encompasses the same principles but with fewer technical experts involved. The overall charter is described explicitly in ALS procedure BL 08-16.

The Staff Safety Committee members are appointed by management and are broadly representative of the ALS. Upon request, it can create ad hoc Technical Safety Committees (TSC) to investigate complex technical safety issues and make recommendations to management. It also performs investigations of incidents when appropriate. Its specific charter is described in procedure ALS 08-03.

Lastly, all staff and managers have on-going safety responsibilities and devote a fraction of their time to safety. Examples include monthly safety circle meetings, time spent on the annual self-assessment inspections, supervisor walkarounds, etc.

Commensurate with its commitment of staff time, the ALS also commits significant funding to safety projects. Each year, funding is set aside to meet these needs. A central "safety first" project ID is maintained to deal with issues on the accelerator floor that might otherwise not be addressed.

Figure 2: ALS Safety Functions Organization Chart



4.0 ISM FUNCTIONS

This section documents how ALS performs the five functions of Integrated Safety Management. Because of the nature of the facility, these functions are all implemented in a tiered fashion. ISM of the accelerator facility is primarily implemented via high level systems that meet Accelerator Safety Order and 10 CFR 835 requirements; safety of the ALS and matrixed staff is through standard LBNL PUB-3000 mechanisms; and safety of the users is through ALS-specific tools developed especially for users at a large user facility.

Accelerator

Work involving the accelerator has been comprehensively evaluated through a Safety Analysis Document (SAD). The SAD and the process by which it is developed, reviewed and maintained are governed by the Accelerator Safety Order, DOE 420.2. It incorporates, at a high level, the ISM functions for the accelerator facility as a whole. Through the SAD process, a detailed catalog of ES&H risks associated with running the ALS is developed and evaluated. The mitigations to control those risks are identified and, in particular, a safety envelope is developed that defines the parameters of safe operation. Internal procedures have been developed, as appropriate, to implement these requirements.

The Safety Analysis Document (SAD), Accelerator Safety Envelope (ASE), and implementing procedures have been internally generated by the ALS. Review and update occurs when changes to the ASE or SAD have been needed. All reviews are performed by *ad hoc* committees of subject matter experts from similar institutions.

The ASE is executed through a series of procedures and training that describe the detailed methods for designing, controlling and verifying shielding, interlocks, access control, etc. These procedures are overseen by the Radiological Work Authorization (RWA) and are reviewed periodically.

Additionally, the ALS has developed work planning and control tools to coordinate the complex tasks associated with maintenance, repair, and upgrades. Large-scale upgrades have rigorous project management tools applied; maintenance days have work planning scheduling, coordination, follow-up meetings; and individual complex tasks may have work permits to guide their execution.

Beamlines

A significant component of the ALS facility is its beamlines. To date, 40+ beamlines (including branches) have been installed. All beamlines undergo a thorough ES&H evaluation at significant stages in their design, installation, and operation, which exactly reflect the ISM functions. At conceptual design, the fundamental scientific rational and design is proposed ('define the work'); at beamline design review, all of the hazards have been identified – in particular radiation safety – and requirements to build specified ('identify hazards and controls').

Throughout installation, project staff work with subject matter experts to assure that build-out conforms to the beamline design requirements. This is verified before the beam is allowed to receive first light in a beamline readiness review and associated walkthrough (‘perform work’). Annual beamline readiness reviews are performed to verify that the controls are adequate (‘feedback and improvement’). This process is proceduralized (BL 08-16) and overseen by a standing technical committee composed primarily of ALS and Engineering staff.

Because most of the ALS floor is now built out, much of the beamline design and development work now consists of upgrades and on-going improvements. Consequently, ALS has developed an abbreviated process to help guide these types of work. It follows the same logic as the full process (conceptual, design, and readiness reviews), but is scaled back to the tasks at hand. Nevertheless, the same level of rigor in the reviews is still applied.

Users

More than 2,000 users each year come to the ALS for periods ranging from a day to months. Special ES&H systems have been instituted to assure that their work receives proper review and oversight. The process begins at the time prospective researchers apply for beamline time through a scientific peer review procedure. When they submit the proposals, hazard information is also identified. When their proposals are accepted and time is allotted, the Experiment Setup Coordination unit contacts the principal investigators to verify the hazard information, personnel who will be on the user team, and follow up on non-routine hazards that require EH&S Division or other subject matter expert review. By the time users arrive, most hazard and hazard control information would have already been reviewed. Before work begins, a physical inspection is conducted. This process has been accepted by EH&S Division as an alternate system to the Lab’s new Job Hazard Analysis (JHA) program and is implemented through Experiment Safety Sheets (ESS) and procedure US 02-05.

Staff Work

All routine work is reviewed and authorized through JHA. The great majority of non-office individuals were enrolled in a group ‘Beamline Staff’ JHA. This is written to be very broad, with individual sections identifying thresholds beyond which further review is required (where possible and appropriate). Lastly, many classes have been added to the default training profile, primarily for the purpose of increasing staff knowledge of the hazards and controls and thereby increasing understanding of the limits of their routine work authorization.

In addition, an analysis was performed to explicitly identify all affiliates (post-docs, grad students, doctoral fellows, etc.) at the beamlines to assure that they have proper supervision and work review and authorization. See the next section on Affiliates for more details.

Different mechanisms are in place in each work group to identify non-routine or complex tasks and review them appropriately. For example, on the Operations/Engineering side, weekly meetings are held to review and coordinate shut-down work. Extended shut-downs go through extensive work planning and review. Thresholds have been identified that specify when the work becomes so complex or there are enough hazards that an ALS Work Permit must be implemented. The proposed work is reviewed by an inter-disciplinary team to identify any ES&H, scheduling, technical, or quality issues.

The division strives to include adequate discussion and communication amongst individuals involved, in addition to standardized algorithms or electronic tools. By focusing on discussion and communication, the division believes that better teamwork will be generated and more issues will be identified and resolved, thereby enabling the staff to have a greater consensus and understanding for the hazards and controls, and be more prepared for contingencies.

On the beamline side, efforts are under way to develop ‘work planning sheets’ that describe how work is planned and reviewed at each beamline, with clearly defined roles and responsibilities of staff/affiliates/users. Because of the multiplicity of beamline characteristics (number, staffing levels, user base, technical challenges, operating times, etc.), there are several different models.

A key component of work planning is the ALS Procedures Center. Much of the work is proceduralized and a controlled procedure system has been well established. ALS has instituted the ALS Procedures Training Database, which is essentially an analog to the JHA to ensure that all staff members who utilize these procedures are trained to the current revisions.

Affiliates

As part of its scientific mission, the ALS hosts many intermediate to long-term guest researchers including visiting faculty, graduate students, etc. Regardless of their appointment level, length of appointment, funding source, etc., their work will receive the same review and authorization as staff. A special orientation package has been generated to assure that they are integrated into these standard LBNL mechanisms in a smooth and reliable manner. Each affiliate is required to have an active JHA.

Vendors

All vendors who propose to perform work on the floor go through both the Lab’s SJHA process (to identify internal controls needed specifically for their tasks) and an ALS work planning system (to identify controls needed for the interface of that work with the accelerator facility). This process is facilitated by the ALS Facilities Specialists who help individuals through the process and assures consistency of application and documentation. Depending upon that interface with the accelerator, a full ALS Work Permit may be applied. The great majority of vendors who work on the Accelerator Floor receive constant oversight.

Visitors

As part of its mission, the ALS makes itself available for public tours and several tours each week are given. Most are either through internal ALS staff or the Public Affairs Office (and CSEE). All LBNL staff giving the tours are trained in an ALS procedure and understand their roles and responsibilities to provide for safety of guests at the ALS. Occasionally, during periods of particularly intense work, these tours are accompanied by ALS safety support staff.

5.0 TRAINING

All staff and affiliates must complete the JHA process within 30 days of their start date at the ALS. All training is tracked through the EH&S Division training database and evaluation of this training completion is a part of the PRD process.

Additionally, all staff who require unescorted access to the ALS experimental hall (Building 6, room 1000), are required to take GERT and ALS 1001: Safety at the ALS. Presently, GERT and ALS 1001 are required to be renewed on a two-year cycle. Both are made available through the Internet. Card-key access to the floor is contingent upon maintaining currency in these two courses. The Training system is now linked to the card-key system so that only those with current training maintain card-key access to the floor.

Users must also take GERT and ALS 1001. The ESS process is an approved alternative to the JHA, so all of their training is specified through that process. As part of the registration process which is administered by the User Services Office, these courses will show up automatically as required training and is verified before they can be issued access badge to the ALS. Since users must re-register annually, training status is updated annually also through this process. Some users may perform work that exceeds this typical bound (i.e., laser, chemical hygiene, biosafety, etc.). In those cases, additional training is identified and implemented via ESS.

On-the-job training is also provided to users. General beamline orientation and technical/safety issues are covered by the Beamline Scientists. Currently there are no standardized requirements for performing or documenting this training. ALS is working with LBNL's Work Planning and Control (WPC) group to develop effective tools for this.

Because a significant component of work at the ALS is performed through procedures, the ALS has established a tracking system (based on the JHA) to identify and track training on procedures.

6.0 ASSURANCE

To assure that the overall ES&H systems at the ALS are robust and effective, the ALS has implemented a systematic assessment approach that is matched to the needs of a large-scale user facility. For convenience, we group the assessments into categories. Process-driven assessments are those required by higher tier documents and are proceduralized to some extent. Operational assessments derive directly from the mission statement in trying to help the user staff perform their science in a safe manner. They have both an assistance and an oversight function. As with other divisions, supervisor walkthroughs are an integral component as is the annual self-assessment. These two are designed to be complementary with supervisor walkthroughs concentrated on work practices and the self-assessments concentrated on work environment.

Following is a list and short discussion of these assessment functions:

<u>Process-driven assessment</u>

Due to the nature of work at the ALS, assessment is an on-going function. Process-driven assessments are those performed by procedure as part of facility-based or institutional requirements. Examples are interlocks tests, projects that might extend beyond the Accelerator Safety Envelope, and Beamline reviews. Other examples are AHD or RWA-driven inspections. Examples are:

- Experiment Safety Sheets. Each experiment requires an inspection and verification before work can begin. Additionally, annual renewals are conducted for long-term projects. These are described in procedure US 02-05.
- Beamline Review. Assessments are performed at each stage in the development and installation of a beamline (and modification of a current beamline). Annual walkthroughs are conducted to assess on-going safety. These are described in procedure BL 08-16 Appendix IVc.
- Interlocks. Design, installation, and modification of personnel safety interlocks undergo a thorough evaluation by an ad hoc technical safety committee before they are implemented. This is described in procedure EE 02-01. All personnel safety interlocks (Radiation Safety System—RSS) undergo either six month or annual inspection and verification.
- Accelerator Projects. In order to assure that accelerator projects stay within the bounds of the SAD and the ASE, reviews are conducted. These assessments are described in procedure ALS 08-01.
- Other more standard LBNL examples include formal authorizations such as AHDs, RWAs, lead compliance plans, drill permits, etc. that all have assessment and evaluation components in them.

Operational Assessment

Another type of assessment can be categorized as operational. Examples of these are the function of the Floor Operators. Their positions implement radiation safety for the beamlines. They are radiological workers on the ALS RWA and are charged with maintaining configuration control of the beamlines. They spend a large part of each shift walking by each beamline as a part of this verification.

Another example is the Experiment Setup Coordination unit. As part of their function, they also walk the floor and interact with the users and beamline scientists to verify the accuracy and effectiveness of the ESS.

The ES&H Program Manager performs risk- or compliance-based walkthroughs that focus on high hazard or high compliance risk functions. These include biweekly walkthroughs of the division's SAAs, inspection of any on-going ALS Work Permits, lead compliance plans, etc.

Supervisor Assessment

At the ALS, first-line supervisors spend a significant part of each day in the field working with their staff and evaluation of safety is integrated into this process.

Second-level and higher supervisors accomplish their walkaround responsibilities by participating in the annual beamline/endstation reviews. They are considered to be the technical experts in work planning, training/qualification, and general organization/housekeeping. Additionally, they follow up on the open issues raised by the other technical experts (i.e., electrical, mechanical, chemical, vacuum, cryo, etc.)

Annual Self Assessment

ALS organizes its self-assessments primarily by risk. Topical areas that are of crucial importance to the organization (such as accelerator, electrical, user, etc.) are chosen for in-depth analysis. Typically these are performed by subcommittees of the SSC which evaluate chosen topical areas for review. Examples from the accelerator safety reviews include: trending of shielding change form requests, comparison of interlock and shielding work authorizations, trending of dose pre- and post-Top-Off, etc.

In addition to the risk-based focus areas, ALS also performs a broad review of institutionally important criteria such as waste, training, etc. These metrics are taken from overall LBNL criteria, and are considered to be annual 'check-ups'. Therefore, many topics (usually ~10) are chosen and are dealt with at a relatively shallow level.

Independent Assessment

In addition to internal assurance functions, ALS participates fully in independent institutional assurance activities. These are identified below:

- Peer Reviews

As required by the Safety Advisory Committee (SAC), the ALS Division will participate in the peer review that evaluates management systems and implementation of ISM requirements. This review is run by the SAC and typically includes representatives from the Office of Contractor Assurance (OCA), peer research divisions, and EH&S Division.

- Program Reviews

ALS participates fully in any institutional peer or DOE reviews that may occur. Since our division plays such a large role in the Lab, it is incumbent upon us to be active in these types of reviews. Examples include McCallum-Turner ISM reviews, DOE accelerator review, HSS reviews, etc.

7.0 ACCOUNTABILITY

This section defines ALS policy for both organizational and personal accountability for safety incidents.

ALS management recognizes that the great majority of accidents are the result of organizational deficiencies. As such, management accepts accountability for these deficiencies and strives to work with the staff collaboratively to investigate, understand, and remediate areas of deficiency. The division recognizes that humans are fallible and people may at some point make errors. Rather than placing blame and applying punitive actions, ALS considers individuals involved as having made an 'honest mistake' and will work with them to understand the context of the incident and prevent similar errors.

However, a completely no-blame culture is neither reasonable nor desirable, as a small fraction of accidents do result from what are considered unacceptable behaviors. Applying a general pardon for unsafe acts would create a lack of credibility and accountability among staff members. In order to foster and maintain a strong safety culture, it is important to appropriately impose disciplinary measures. The types of behaviors that are considered unacceptable and blame-worthy are:

- Willful violations.
- Repeated accidents:
  Consistent pattern of problems over an extended period of time.
- Reckless behavior:
  Reckless behavior has a different connotation distinguishable from ‘honest errors' and involves an individual's conscious disregard for substantial or unjustifiable risk. Examples are: Ignoring direct warnings, disregarding explicit instructions, and failure to report an incident that may pose a potential risk to other staff members.

These kinds of unacceptable behaviors are usually not considered failures of the organization or safety systems; therefore, disciplinary actions may be warranted.

After a thorough investigation, any event that meets the above criteria may be potentially blame-worthy and subject to disciplinary actions. Before pursuing disciplinary action, the responsible supervisor/PI and the Division Director should first meet with the Lab Director and Chief Operating Officer to review the safety culture in the part of the organization where the incident took place. This higher-level review may identify underlying or contributing causes that need to be addressed first.

8.0 INSTITUTIONAL ISM

The LBNL Institutional ISM Plan was revised subsequent to the 2007 revision of the ALS ISM Plan. The institutional plan was a very large-scale revision. Many of the changes were in areas where the ALS implements the standard institutional programs and the revisions had minor impact to the ALS. Rather than identifying each applicable revision explicitly in our Plan, we acknowledge and incorporate all by reference. Specifically, these include:

- Safety Advisory Committee member assignment
- Building Manager responsibilities
- Telecommuting
- Use of the HMS system to record hazards by location
- Injury/illness reporting, tracking, and analysis
- Use of the CATS system for tracking corrective actions
- Use of the ORPS and SAAR systems for reporting mishaps
- Medical Surveillance
- Emergency preparedness
- Reporting employee concerns
- [New] Working Alone Policy*

*Working Alone is defined as: "Doing work when there is nobody within sight or earshot that can assist in the event of an emergency." The basic LBNL Working Alone policy is based on the following: "Workers at LBNL are not allowed to work alone when the mitigated hazards associated with their work could incapacitate them such that they cannot self-rescue or activate emergency services." Mitigated hazards mean the hazards that remain after the controls are considered.

Most of our areas of concern, such as shops, electrical work area, confined space, and lifts, etc. are already covered by the institutional policy as defined in PUB-3000, Section 5.3. For chemical and biological work in the Users Labs, because of the great diversity in individuals and the tasks performed, we use the task analysis approach and evaluate the work on a case-by-case basis.