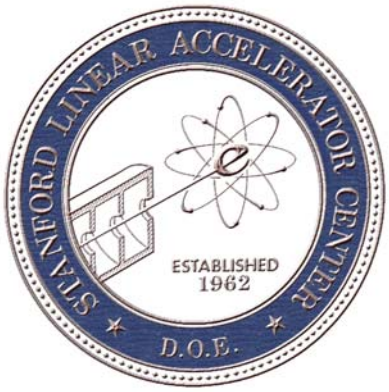

Photon Science Directorate
Integrated Safety Management (ISM) Plan

_____ _____
Jonathan Dorfan, Laboratory Director Date

_____ _____
Keith Hodgson, Director, Photon Science Date

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Annual Review and Update

Photon Science Directorate

Integrated Safety Management (ISM) Plan

The Directorate ISM Plan was reviewed with no substantive changes in either content and/or ES&H resource commitment.

_____ _____
Keith Hodgson, Program Director Date

_____ _____
Ian Evans, Directorate Safety Coordinator Date

The Directorate ISM Plan was reviewed and has the following substantive changes in either content and/or ES&H resource commitment.

_____ _____
Keith Hodgson, Program Director Date

_____ _____
Ian Evans, Directorate Safety Coordinator Date

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1. Introduction

This plan is implemented as part of SLAC's overall Integrated Safety Management (ISM) System. It supports two key SLAC Environment, Safety and Health (ES&H) Policy Documents:

- SLAC's Institutional ISM System Plan
- SLAC's ES&H Manual, especially Chapter 1 – Policy and General Responsibility and Chapter 2 – Work Authorization

More importantly, we follow ISM principles and core functions because they have proven effective in protecting workers, the public, and the environment. The purpose of this plan is to describe how:

- We integrate environmental, safety and health considerations into the planning and work of the Photon Science Directorate
- Our operations meet ES&H policy requirements in the ES&H Manual and other relevant safety policy documents
- We reinforce responsibility and accountability for safety by line management and each individual
- The work of our Directorate is authorized per Chapter 2 of the ES&H Manual
- Activities are analyzed for potential hazards
- Hazards are controlled through the use of tailored controls:
  - Engineering controls
  - Administrative controls
  - Personal Protective Equipment
  - Training and oversight
- Controls are implemented and work is done only within controls
- We implement effective self-assessment and continuous improvement programs (see Chapter 33 of the ES&H Manual)
- Staff competency is assessed and documented
- The Directorate, Division and Department Safety Coordinators support the Directorate program and interrelate
- Requests for programmatic funding include adequate resources to assure safety is integrated with program objectives and to implement ES&H support program

2. Institutional Policies and Organization

SLAC Mission and ES&H Policy

- **SLAC Mission**

Photon Science Discoveries

– To make discoveries in photon science at the frontiers of the ultra-small and ultrafast in a wide spectrum of physical and life sciences

Particle and Particle Astrophysics Discoveries

– To make discoveries in particle and astroparticle physics to redefine humanity's understanding of what the universe is made of and the forces that control it

Operate Safely; Train the Best

- To operate safely a laboratory that employs and trains the best and brightest, helping to ensure the future economic strength and security of the nation

- **Photon Science Directorate Structure & Mission**

Within the **Photon Science Directorate**, there are three individual science programs; the **Stanford Synchrotron Radiation Laboratory** (SSRL) Division, the **Ultrafast Science Center** and **LCLS Ultrafast Science Instrumentation** Project (LUSI). While this management plan covers all three activities, the latter two are recently initiated and are presently encompassed within the SSRL structure, which is a strong and mature program.

The Stanford Synchrotron Radiation Laboratory (SSRL) Division is an organizational element of the Stanford Linear Accelerator Center (SLAC). Its mission is:

> To operate as an integrated, support-oriented, general scientific user facility, enabling world class scientific discovery in both materials/chemistry and complex biological systems, and in structure and properties of materials with nanoscale dimensions. SSRL serves an established, productive and growing user community (2000 users on 400 active proposals).
>
> SSRL strongly believes in and operates within the policy stated by DOE-BES.
>
> "The Office of Basic Energy Sciences (BES) is committed to conducting research in a manner that ensures protection of the workers, the public and the environment, and it is a direct and individual responsibility of all BES managers and BES supported researchers and their staff. Funds provided by BES for research will be applied as necessary to ensure that all BES research activities are conducted safely and in an environmentally conscientious manner. Only research conducted in this way will be supported".

It is the intention of the SSRL Division management and line organization to achieve the aforementioned scientific and technical objectives and compliance with BES directives through the application of Integrated Safety Management System (ISMS) principles. SSRL management is also committed to applying ISMS to:

- Provide the safest possible work environment for all staff, users and visitors
- Ensure that all SSRL staff and users assume responsibility for their own safety and take reasonable care for others who may be affected by their actions

- Provides structure and methods to help achieve zero reportable accidents, injuries or illnesses

SLAC ES&H Policy

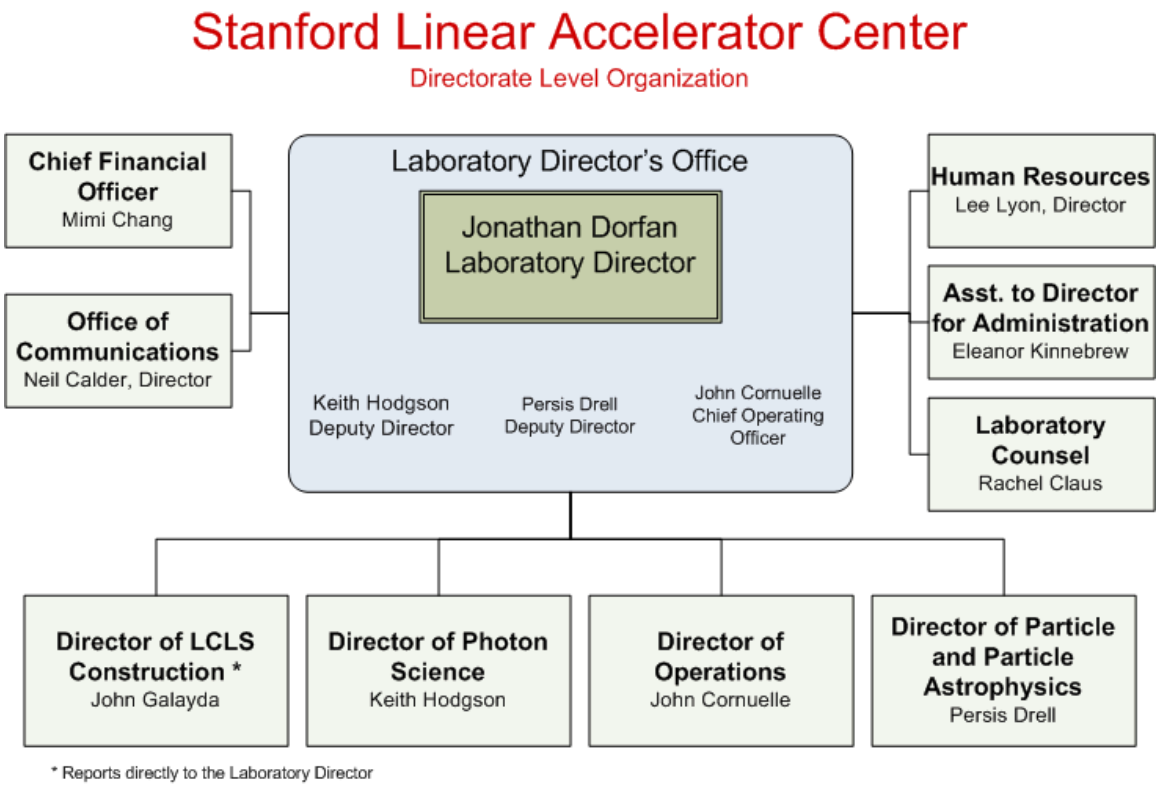
SLAC has committed itself to achieving its mission in the context of a respectful workplace that supports the value of each individual and that persistently strives for excellence in health, safety and environmental matters.

SLAC is committed to protecting the health and safety of those working at SLAC, the public and the environment as it carries out its scientific mission.

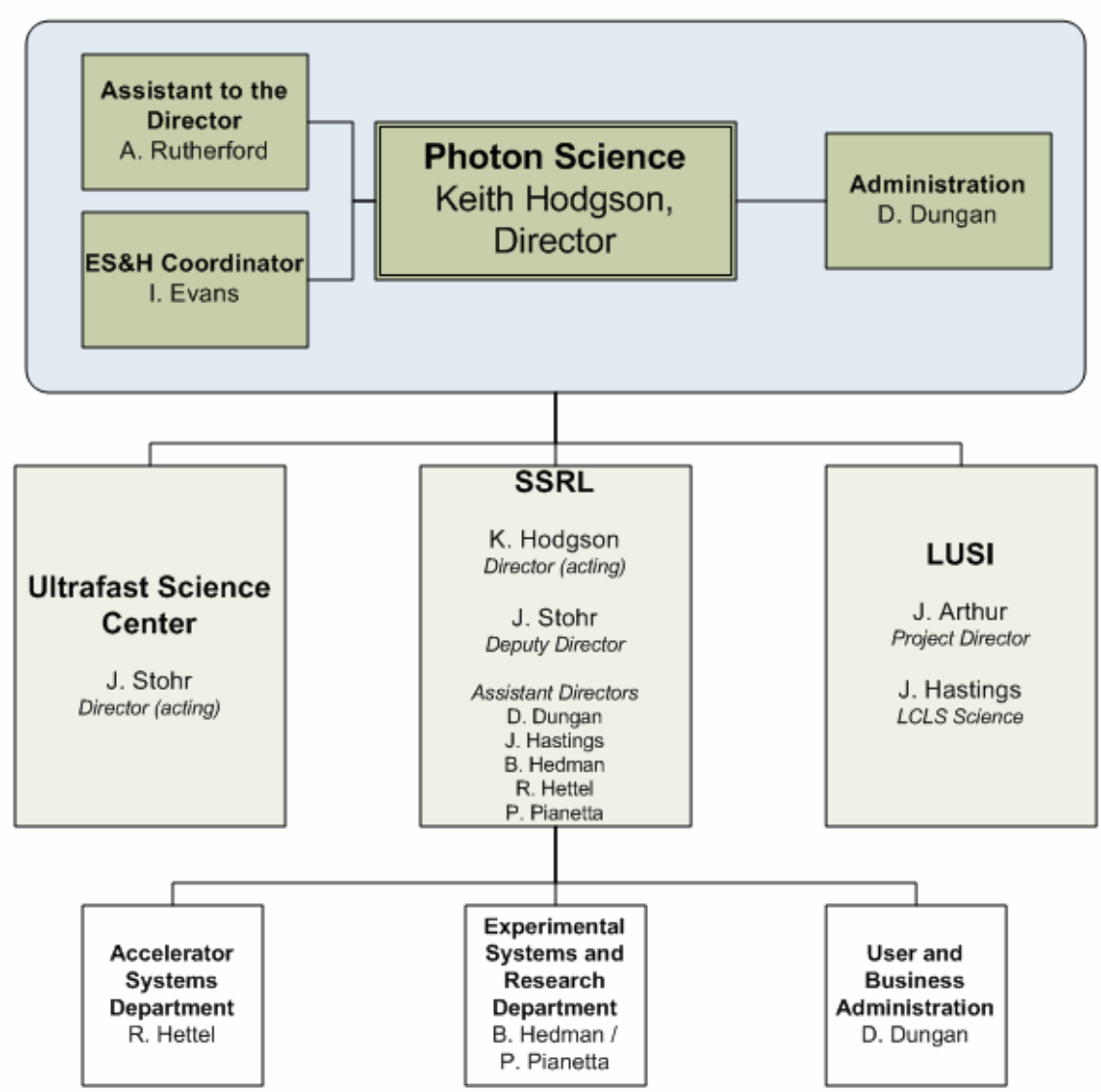
Through employee involvement and management commitment, SLAC will:

- Seek to protect human health, prevent pollution, and eliminate negative environmental, safety and health impacts associated with our facilities and activities throughout their life cycles
- Exercise vigilance to ensure compliance with all applicable, laws, regulations, and best management practices
- Seek to maintain a healthful and safe workplace, free of occupational injury and illness
- Conduct sustainable programs to minimize pollution to environmental media, to protect our material resources, cultural resources, and biota
- Conserve natural resources and minimize our environmental footprint by evaluating the impact of products, services and their providers; by reducing energy and water usage; by reusing and recycling materials; by purchasing and using recyclable materials and energy-efficient devices; and, by exercising pollution prevention measures, whenever technically feasible and economically justifiable
- Conduct operations such that the production of radioactive materials and radiation is maintained as low as reasonably achievable
- Integrate environmental, safety and health into project planning, design, construction, use and closure of facilities to minimize environmental, safety and health impacts associated with the project
- Conduct our activities in a sustainable manner and partner with those businesses that offer sustainable practices and strengthen this commitment through contract language, where practical

SLAC Organization:



Photon Science Directorate Organization



Photon Science Directorate Introduction and Scope of Work

1. The **Stanford Synchrotron Radiation Laboratory (SSRL),** the first synchrotron x-ray user facility in the U.S. and one of four DOE-supported national synchrotron radiation sources, has provided synchrotron radiation to the national and international scientific community since the 1970's. SSRL provides beam time and access to beam lines, instrumentation, ancillary equipment and dedicated user support with a strong focus on serving the general user community. SSRL is primarily supported by the U.S. DOE Offices of Basic Energy Sciences and Biological and Environmental Research, with additional support from the National Institutes of Health (NIH), National Center for Research Resources, Biomedical Technology Program, and the National Institute of General Medical Sciences. The accelerator, SPEAR, was upgraded in 2004 to a 3-GeV, 500-mA capable, 3rd-generation high-brightness storage ring – **SPEAR3**. A parallel upgrade of beam line optics and end station instrumentation, as well as the construction of new beam lines, continues.

   For 8-9 months each year, SSRL operates a broad range of experimental stations from the VUV/soft x-ray to the hard x-ray energy regions of the spectrum with the majority based on high intensity insertion devices. Specialized facilities provide unique capabilities in numerous areas, including: ultra-high resolution Fermi level mapping of high temperature superconductors; x-ray absorption fine structure studies for biological and molecular environmental science (including the handling of radioactive materials related to the cleanup of storage sites from the nation's nuclear weapons program); and macromolecular crystallography using high-performance large-area CCD detectors and automated sample changing and data collection/ analysis approaches. Users have easy access to supporting facilities, such as instrumented sample preparation laboratories, on-line and off-line computer systems, a pool of scientific equipment, and the SLAC Guest House. For over 30 years, SSRL has pioneered technical, methodological and scientific developments, and contributed to the education of the national and international scientific workforce.

   Approximately 2,000 scientists annually benefit from the unique facilities at SSRL, with around half of those users coming on-site at lease once each year to carry out their own research. Results from experiments conducted at SSRL are publicly disseminated through scientific presentations, patents, awards and publications. Over 350 scientific papers are published annually based on research enabled by the SSRL facility. Students are involved in all phases of research, as well as in the development of instrumentation, with graduate students from over 100 universities currently involved in research at SSRL

   The SSRL Division has three main departments that serve to ensure that the mission and goals are reached.

   The **Experimental Systems and Research Department** (ESRD) develops and supports beam lines, instrumentation, methodology and software for the experiments that are performed by the scientific user community on SSRL beam lines, and provides direct user support for the visiting scientists during the performance of their experiments. The department's scientific staff performs synchrotron radiation-based research in several disciplines. The department's facilities / engineering group provide facility services and manage construction and maintenance projects.

The **Accelerator Systems Department** (ASD) develops, operates and maintains the accelerator facilities providing synchrotron radiation to the SSRL user community. These facilities include an electron linear accelerator, 3-GeV booster synchrotron, and the 3-GeV SPEAR3 storage ring. Development and support groups have expertise in accelerator physics, high- and low-power rf engineering, DC and pulsed power conversion systems, magnet and high vacuum systems, mechanical engineering, beam instrumentation and controls, and facilities infrastructure systems. The ASD also supports research and development of high brightness electron gun and accelerator technology and its applications.

The **Administration Department** (AD) supports BES and BER program activities by providing the following services to divisional operating and research units: User support, proposal management and review, beam time scheduling, budget and finance, procurement, personnel, property administration and other services necessary to meet mission needs.

2. A new venture is underway at SLAC and Stanford: the **Ultrafast Science Center** and the construction of the world's first x-ray free electron laser. The construction of this new x-ray source, the **Linac Coherent Light Source (LCLS)**, is funded by the DOE and its operation is planned to begin by 2009. (The LCLS is a completely separate organizational unit within SLAC) The ultrafast science initiative creates an opportunity to attract outstanding scientific talent in advance of LCLS operations and helps ensure that Stanford and SSRL will continue to be at the forefront of advances in the studies of ultrafast phenomena using x-rays and electrons. LCLS will provide x-ray beams of unprecedented brightness, delivered in femto-second pulses with full transverse coherence. Pushing the frontiers of LCLS performance will challenge and engage the talents of accelerator, laser, and x-ray physicists for years to come. Building on and leveraging existing strengths, four areas will form the core competencies of the new Ultrafast Science Center, which underpins the science programs of the LCLS: atomic physics, chemistry, biology, and condensed matter physics. The Center will focus on ultrafast structural and electronic dynamics in materials science, the generation of attosecond laser pulses, single molecule imaging, and the origin of efficient light harvesting and solar energy conversion in molecular systems during the first three years of operation.

   The **Sub-Picosecond Pulse Source (SPPS)** experiment is a collaboration involving SSRL and other external institutions. The SPPS uses the existing SLAC linear accelerator (linac) along with specialized new instrumentation to produce extremely short pulses of electrons and x-rays. This experiment provides a fast, relatively inexpensive way to begin studies with a new generation of very bright, sub-picosecond (less than one millionth of one millionth of a second) hard x-rays. A magnetic undulator produces an ultra-short pulse of high-brightness x-rays from the linac electron beam. One of the unique features of the SPPS is its combination of brightness and sub-picosecond pulse length. The peak brightness in a single pulse of the SPPS beam exceeds that of any existing hard x-ray source by several orders of magnitude. This combination allows the collection of flash measurements of the atomic positions of materials as they undergo changes following an impulse from an ultrafast optical laser. These studies are providing the opportunity to gain direct insights into important processes such as structural changes during actual chemical reactions. The SPPS will operate until mid-2006 and plays a vital role in the R&D of accelerator and x-ray optics for the LCLS. SPPS researchers are developing and refining the diagnostic tools associated with the production and use of ultra-short electron and x-ray pulses, and they are gaining valuable experience that will be applied to the early operation of the LCLS. Much of the hardware and knowledge

associated with this experiment will be transferred into the Ultrafast Science Center as it develops.

3. A suite of x-ray instruments for exploiting the unique scientific capability of the LCLS will be constructed by the **LCLS Ultrafast Science Instrumentation (LUSI)** project**.** The LUSI project, currently in the planning and design phase, expects to receive major funding starting in 2007 to build four instruments over a period of about five years. (CD0 has juts been approved by the DOE for the LUSI project) Two of these instruments will be optimized for hard x-ray studies of ultrafast dynamics at the atomic level, addressing basic problems in chemistry and materials science. A third instrument will concentrate on hard x-ray coherent imaging of nano-particles and large bio-molecules. The fourth instrument will give LCLS the capability of using soft x-rays to study magnetic structures and surface chemistry. These instruments will complement other instruments at LCLS, which are directed towards atomic physics and plasma physics.

Management Roles, Responsibilities and Authorities

The roles, responsibilities and authorities for key ISM elements of the Photon Science Directorate (PSD) are outlined below:

SLAC Director for PSD

- Leads the scientific mission for PSD programs at SLAC
- Ensures safe, effective and efficient laboratory operations and business practices
- Communicates the laboratory mission, strategy, values and expectations to lead elements within PSD
- Manages development of facilities and resources necessary to accomplish the PSD mission
- Advocates proactive stewardship of all government and university resources within sphere of responsibility
- Identifies, with program managers, the resources needed to carry out the Directorate's mission including all ES&H requirements
- Describes and effectively implements this ISM plan for the PS Directorate
- Ensures an open and supportive work environment where staff are free to report issues and concerns without fear of retribution
- Investigates all high hazards or imminent danger situations to ensure that timely and effective corrective action plans are developed and implemented
- Communicates lessons learned
- Leads and ensures management commitment to environmental, safety and health

Roles and Responsibilities for the Directors of SSRL, LUSI and Ultrafast Center

- With the recent re-organization and appointment of a Photon Science Directorate, the roles and responsibilities for the Directors of the SSRL Division, LUSI Project and Ultrafast Science Center have not been established. It is envisaged that these positions will encompass elements from the R&R outlined in both the PSD Director and those of the Assistant Directors within SSRL.

Assistant Directors for Administration, Experimental Science & Research Department, and Accelerator Systems Department within the SSRL Division

- Assistant directors are assigned stewardship responsibility for major elements of the laboratory's scientific technical and administrative support capabilities
- Allocate resources and determine priorities for staff and manage human resources (performance, salary, development and discipline)
- Ensure individual performance goals are set, progress evaluated, and feedback provided to all staff and addressing performance issues professionally and timely
- Prioritize and allocate resources for program development to support growth in the laboratory and its scientific mission
- Lead departmental management commitment to environmental, safety and health, ensuring a safe and compliant operation and work environment, effective use of good business practices and to ensure that lab performance objectives are met through completing projects and programs on-time, on budget, and that they meet scientific, technical and business expectations
- Authorize work in their departments after ensuring that all safety functions and checks have been completed
- Reports to the SSRL Director on all issues of environmental, safety and health

Department Heads/Group Leaders

- Provide leadership for group programs/projects
- Develop and provide budget request to assistant director for funding consideration
- Ensure appropriate priorities are set and resources allocated in department for environmental, safety and health, programmatic and operational considerations, including waste disposal, radiation physics staffing etc.
- Ensure individual performance goals are set, progress evaluated, and feedback provided to all staff, addressing performance issues professionally and in a timely manner
- Ensure program follows all required assessment and review steps and authorizes work in the program
- Approve work and ensure all work activities are performed in compliance with environmental, safety and health requirements
- Work with system managers to document, prioritize and assure correction of facility and equipment problems; report deficiencies beyond existing resources to division management
- Supervise and mentor scientific and technical staff
- Implement ISMS at ground level
- Are responsible for safety in R&D efforts carried out by scientific and technical staff reporting to him/her

PSD ES&H Coordinator

- Reports to the director for Photon Science
- Assists line management in assessing the effectiveness of the safety and health programs adopted and provides recommendations for maintaining and improving on them
- Assists line management in the identification and evaluation of workplace hazard and development of measures for their control
- Maintains a working knowledge of the SLAC ISMS and Work Smart Standards set

- Carries out oversight functions for the Director: coordinates walkthrough, self assessment, corrective actions, etc.
- Communicates and meets regularly with line management and staff on ES&H issues.
- Assists line management in the investigation of accidents and incidents
- Promotes safety in the organization through active participation

3. Integration of Environment, Safety, and Health into the Photon Science Directorate

Integrated Safety Management

The principle of line management responsibility for safety is implemented through the project/division directors, assistant directors, their program managers, department heads, group leaders and staff. A clear understanding of the responsibility for hazard analysis and hazard control is understood at all levels from the PSD Director to individual staff members.

- The director assures that program managers identify and control hazards before authorizing experiments or other work to begin
- Program managers require facility Safety Assessment Documents (SAD) to be reviewed periodically and kept current, R&D projects have integrated hazard analysis, safety plans are developed and approved for major facility modifications, daily operations incorporate safety planning
- Department heads, group leaders and supervisors work within SAD requirements, develop with their employees routine JHAMS and, utilize non-routine JHAMs for unusual or infrequently performed work, utilize work or experiment authorizations to assure procedures are followed by all participants and develop AHAs.
- Employees are trained on general safety and specific procedures for their work, participate with their supervisors in developing AHAs and JHAMS, review AHAs in other areas

Safety including all aspects of environmental, safety and health, like research integrity, scientific discipline, and fiscal responsibility, is a product of culture and sound management. To achieve a truly integrated systems approach to doing work safely, environmental, safety and health must be an integral part of work from initial planning through final execution. SLAC uses ISM's seven guiding principles and five core functions to achieve ISM. All are reflected in the detailed policies and procedures of the Laboratory. Documents that are key policies for our directorate include:

- SLAC ISM Plan
- ES&H Manual
- Radiation Control Manual
- Guidelines for Operations

Line Management (including principal investigators, managers, and supervisors) are responsible and held accountable for incorporating these principles and environmental, safety and health policy into the management of our work.

ES&H considerations must be part of all planning processes, commencing with identification of work scope, identification of hazards, what standards apply, what controls are to be implemented, the competencies required to work safely, and finally the assurance that each of these elements are in place before work is authorized to proceed.

SLAC's line management focuses on safe accomplishment of mission, understanding assignments, and carrying out the core safety management functions correctly and efficiently. These principles are dependent both upon management commitment and

employee/individual involvement and accountability. Management commitment is demonstrated by:

- The documented ISM and environmental, safety and health policy statements that are communicated throughout the organization
- Managers' accountability for safe work performance
- The visible presence of managers addressing safety issues
- Fostering employee involvement in development and implementation of the ISMS
- Emphasizing the importance of individual accountability for performing work safely through goal setting, accountability in the personnel evaluation system, and environmental, safety and health training

Employees/workers must be actively and continually involved in the development and deployment of the ISM processes that execute the ISM function. As individuals and as work teams, employees/workers actively participate in the activities of the ISM processes that address workplace safety, public safety, and environmental protection. Employees/workers continually examine the ISM management processes used to conduct their individual work efforts for continual improvement and actively pursue these improvements with contractor management. Individual accountability for performing work safely is emphasized.

The following sections describe key ISM issues unique to the Photon Science Directorate

3.1 Photon Sciences Directorate's Work Activities

See earlier section, "Introduction and Scope of Work"

3.2 Work Authorization

The process for authorizing and performing work on accelerator or beam line systems is a structured process that is dependent on management review and approval. There is a common theme between both work groups, but the process varies slightly.

Accelerator Systems Department

ASD managers, with the help of system managers and support group supervisors and with direction from SSRL Directors (in periodic directorate meetings), define the high level work and schedule requirements to achieve the mission of the lab. The scope and planning of detailed work tasks are performed by System Managers, who define technical requirements and direction, together with support group staff as needed. Planning is aided by periodic support group meetings, System Manager meeting's, accelerator maintenance day planning meetings and daily operations meetings during user runs. The hazards associated with planned work are assessed and mitigated using JHAMs for routine activities, non-routine JHAMs for special uncommon tasks, and Electrical Work Plans (EWPs) for work on or near exposed electrical hazards. Safety procedures are used or created for the work tasks as needed. Supervisors are responsible to ensure that hazard assessment and mitigation are carried out before work begins. Supervisors assign work tasks to personnel based on worker qualifications, including training and experience, as determined by the SLAC Training Assessments (STA's) and task-specific training. Authorization to work on an accelerator system comes from the Area Manager and Accelerator Program Manager or their delegates as

described in Chapter 4 of the SPEAR 3 Safety Assessment Document (SAD). During accelerator operating periods, workers must contact the Accelerator Operator before beginning work. The Operator shall receive confirmation from work team leader that the task safety requirements and authorizations have been fulfilled before work is started, and make an operator logbook entry. During accelerator shut-down periods, task safety requirements are reviewed by the Area Manager. Work is performed according to the steps above, following procedures as deemed necessary. Supervisors are responsible to assure that their workers perform the tasks using the safety controls identified in the hazard assessment. When work is complete, the Accelerator Operator shall be notified and an entry shall be made in the accelerator operator logbook or in the maintenance/shutdown schedule as appropriate. The worker(s) shall discuss any work issues or concerns with supervisor(s).

Experimental Systems Research Department

ESRD managers, with the help of system managers and support group supervisors and direction from SSRL Directors (in periodic Lab Management Group meetings), define the high level work and schedule requirements to achieve mission of lab. The scope and planning of detailed work tasks are performed by ESRD group leaders, who define technical requirements and direction, together with their respective staff. Coordination between the ESRD groups is accomplished by bi-weekly meetings of the ESRD Heads with the group leaders and beam line responsible scientific staff. Coordination with ASD is aided by ESRD staff attending accelerator maintenance day planning meetings and daily operations meetings. The hazards associated with planned work are assessed and mitigated using personnel JHAM's for routine activities, non-routine JHAM's for special uncommon tasks and Electrical Work Plans (EWP's) for work on or near exposed electrical hazards.

Safety procedures are used or created for the work tasks as needed. Supervisors are responsible to ensure that hazard assessment and mitigation is carried out before work begins. Supervisors assign the work tasks to personnel based on worker qualifications, including training and experience, as determined by STA's and task-specific training. During down times, authorization to work on a beam line system comes from the beam line responsible engineer. During accelerator operating periods, the responsible beam line engineer must obtain concurrence from the Beam Line Program Manager to insure that overall beam line operations are not affected and to insure coordination with accelerator operations. Any work that could potentially affect accelerator operations is coordinated by the Beam Line Program Manager with the Accelerator Program Manager. The responsible beam line engineer will insure that the task safety requirements and authorizations have been fulfilled before work is started, and make an entry in the beam line log book. Work is performed according to the steps above, following procedures as deemed necessary. Supervisors are responsible for assuring that their workers perform the tasks using the safety controls identified in the hazard assessment. When work is complete, the beam line responsible engineer shall be notified and an entry shall be made in the beam line logbook or in the maintenance/shutdown schedule as appropriate. The worker(s) shall discuss any work issues or concerns with their supervisor(s).

User Administration

During the SSRL experimental proposal review process, each proposal or letter of intent is initially reviewed by the SSRL Safety Officer, and other subject matter experts as

appropriate, to determine the types of hazards and the level of risk they may pose. Proposed methods to mitigate the hazards through engineered controls (preferred), administrative controls or by using Personal Protective Equipment (PPE) also are reviewed at this time. When a proposal identified as having potential hazards during the initial review (proposals marked with a safety star, "*") is scheduled for beam time, an SSRL Hazards Form is sent to the proposal spokesperson. The spokesperson is required to complete a form for each potential safety hazard and return this with the required relevant safety information (e.g., Material Safety Data Sheets) to the User Research & Administration (URA) office. The SSRL Hazards Form solicits detailed information about the substances and/or equipment to be brought to SSRL. Upon receipt of this information, a comprehensive safety review is conducted and any deficiencies or concerns are resolved. The review may include outside organizations as appropriate, dependant on the nature and magnitude of the hazard, or if institutional policy requires such review; such as for Biohazards, the use of live animals or working with actinide materials.

When hazards are identified, a Safety Review Summary (SRS) is prepared by the SSRL Safety Officer that outlines the hazards and the controls to be implemented and is sent to the proposal spokesperson for concurrence and signature. Where applicable, the SRS will also stipulate any safety procedures, manuals or other related documentation that the user/experimenter must reference to ensure that all environmental, safety and health concerns are addressed prior to and during the conduct of their experiment. Prior to conducting the work described in the proposal, the spokesperson must sign the SRS, which includes the following statement: *The above safety information describes all known potential hazards associated with this experiment, and all procedures necessary to maintain a safe, healthful environment while at SSRL. All personnel participating in this experiment will receive training in standard and emergency procedures relating to the hazards associated with this experiment.* All of the above is completed prior to permitting the users associated with the proposal to begin that work on-site.

3.3 **Hazards Associated with the Operation of SSRL**

The hazards associated with the operation and maintenance of SSRL have been identified and documented through various processes. Some of these are more dynamic than others in order to capture a changing environment.

- SPEAR3 Environmental Assessment
- SPEAR3 Safety Assessment Document
- SSRL - 3 Gev Injector Safety Assessment Document
- Area Hazards Analysis (AHAs) for all buildings and spaces
- Job Hazard Analysis and Mitigation (JHAM) process for all staff
- Proposal Review Process for User based experiments
- SLAC Site-Wide Hazards Assessment

Typical hazards are:

- Ionizing radiation from accelerator, x-ray generators and the storage and use of other radioactive materials
- Non-ionizing Radiation Exposure for lasers, UV and RF
- Electrical hazards – including high voltage/high power
- Construction hazards
- Seismic hazards
- Exposure to hazardous materials during maintenance and research activities

- Thermal hazards (hot and cold) from component bake-outs and the use of cryogenic liquids
- Oxygen deficiency
- Industrial hazards (general OSHA), including those involving:
  - Walking-working surfaces (guarding, elevated work areas, trip hazards)
  - Means of egress (emergency plans, fire preventions, housekeeping)
  - Powered platforms, man-lifts and other vehicle mounted platforms
  - Personal protective equipment (PPE)
  - General materials handling and storage (cranes, forklifts)
  - Machinery and machine guarding (abrasive wheels, machine tools)
  - Hand and portable powered tools
  - Welding, cutting and brazing
- Hazards relating to the operation of shops in the following fields, including:
  - Vacuum hardware and component installation,
  - Machining and machine tools
  - Chemistry and Biochemistry (wet) laboratories
  - Computer rooms
  - Electronic test and development
  - Electrical test installations

3.4 **Hazards Controls – Development and Implementation**

Throughout SSRL, groups acknowledge and develop controls for hazards by making sure there is strong communication between supervisors and individual workers, ensuring that authorization to start an activity does not come before the following fundamental topics have been addressed, and that staff, users and sub-contractors:

- are properly trained
- understand the hazards they may encounter and how to mitigate them
- recognize that safety is always the highest priority in any work assignment.

This is accomplished through the use of the JHAM and AHA processes, annual performance evaluations, Staff Training Assessments, and internal documentation. Each person is given the opportunity to assist his or her supervisor in creating a high level of safety awareness and job readiness, in addition to expressing any concerns with an assigned task.

Although eliminating the hazard or removing it through engineering controls is always preferable, administrative controls such as internal procedures or work authorizations provide methods by which line managers can ensure that hazards are mitigated. Discussion about these controls with workers during JHAM development with the worker contributes to a continuous improvement process. Required PPE is provided by the supervisors and is called out in the JHAM before the job is performed.

SSRL uses several means to ensure workplace hazards are identified and controlled:

- Managers define the high level activities and schedule, while system managers and support group members define the detailed scope of the work. Responsibility for each activity is assigned to a line manager (Assistant Directors, Group Leaders, System Managers, Program Managers, Area Managers etc.)

- Hazard analysis is routinely carried out in the work planning process, including using information defined in Safety Analysis Documents, activity-related JHAMs, AHAs, Electrical WorK Plans (EWPs), User Proposals and SLAC site hazards assessment
- Hazard controls are implemented by the individuals performing the activities, with oversight through their direct line managers. Responsibility for each activity is assigned to either line management or project managers
- The opportunity and expectation that feedback and improvement are discussed, exists in meetings with direct supervisors, shut down meetings, daily operations meetings and are explicitly called out as a line item for activities requiring non-routine JHAMs

Work at SSRL lies in the following categories:

1) **Office work**, both administrative and technical – hazards are controlled via routine JHAMs and AHAs.
2) **Benign, Immediate and Scheduled Maintenance** – Hazards are controlled via JHAMs, AHAs and applicable permits (e.g. EWPs) and other pertinent operating documents.
3) **Accelerator and Beam Line Operations** – Hazard review and mitigation is handled by the appropriate program/system manager, with review by appropriate ES&H SMEs, safety committees and the JHAM process. Extensive documentation is required and periodically updated to comply with DOE orders.
4) **Subcontractor Activities** – Hazard review and mitigation is handled by the Project Manager, with review by appropriate ES&H SMEs, safety committees and JHAM process. Design reviews, documentation updates and postmortems etc. are required for construction projects.
5) **Construction & Operation of Experimental Equipment** – Hazard review and mitigation is primarily developed by the lead investigator with ES&H coordinator advice. Non typical hazards are then reviewed by the appropriate Citizen Safety Committees or ES&H SME's. Work is covered via routine and non routine JHAMS and the SSRL Experiment Proposal Review process.

Facility and Building Management

The director has established clear lines of responsibility for all facilities within the Photon Science Directorate by identifying building, area and system managers, who are responsible for assessing potential hazards, their mitigation and to maintain a safe work environment.

Major Facilities in the Photon Science Directorate

There are several accelerator facilities, research and development laboratories, maintenance shops and offices. This work environment provides a broad array of potential hazards which must be identified and controlled.

The major facilities and responsible department are as follows:

The SSRL Accelerator Complex (ASD – R. Hettel)

The SSRL beam lines (ESRD – P. Pianetta)

The major office building and responsible department are as follows:

SSRL Main Office – Building 137 (Building Manager – Todd Slater)

SSRL User Office – Building 120 (Building Manager – Brian Choi)

Within SSRL there exists a support framework that allows the accelerator and beam lines to keep operating and includes examples of work with exposure to high-hazards which are carefully controlled.

- **Machine Shops:**
  - rotating machinery: machine guarding, proper attire
  - flying objects: machine guarding, eye protections
  - dropping heavy objects on feet: foot protection
  - exposure to chemicals (solvents, degreasing agents, lubricants): PPE
- **Sample Preparation Laboratories:**
  - chemical exposure: effective ventilation, proper PPE
- **Vacuum installation and precision assembly:**
  - high voltage: LOTO, barriers, PPE
  - hot/cold temperatures: signage, PPE
  - mechanical hazards: machine guarding, proper attire
  - hoisting and rigging: training, appropriate use of lift plans and hardware
  - exposure to chemicals (solvents, greases): PPE
- **Electronic Assembly and Test Shops**
  - high voltage: LOTO, barriers, PPE
  - AD/DC: LOTO, PPE
  - soldering: ventilation, PPE

Additional ways in which hazards are controlled are:

- Signage is posted for radiologically-controlled areas and other limited access situations; for equipment where specific PPE or training is required; and in other situations.
- Area Hazard Analyses (AHAs) acknowledge hazards, are updated regularly, and are readily available.
- Directorate/division/department meetings, with safety as a line item
- Periodic self-inspections by supervisors and/or ES&H coordinator
- Annual walkthrough inspections by associate director, assistant directors and appropriate staff (building, area managers etc)
- Annual emergency evacuation drill and update of Facility Emergency Plan
- Ergonomic evaluations
- Specific safety training
- Fume hoods
- Periodic recalibration of testing equipment; survey meters, oxygen deficiency meters

3.5 How We Ensure Our Work Is Performed Within Controls

Photon Science Directorate ensures that all work conducted in our jurisdiction is performed within controls through the use of JHAMs, AHAs, task or equipment specific procedures (operational and maintenance), electrical work plans, job performance evaluations, routine supervisor oversight and field inspections, ES&H Coordinator involvement, and random checks by senior management.

In addition, Citizen Committees provide guidance as needed or required (e.g. Earthquake Safety), and Safety Officers (Laser, Electrical, Radiation, Pressure Vessel Safety) augment the committees and report directly to the SLAC Director. Finally, subject matter experts (SMEs) in ES&H and elsewhere on site are used regularly to help individual work groups move forward in a safe and efficient manner, using current knowledge and technology while complying with any applicable regulatory drivers.

3.6 Continuous Feedback and Improvement

The director, program managers, facility managers and line managers are expected to examine their processes and procedures periodically to assess their effectiveness. Appropriate review and revision are expected at all levels of activity. This includes:

- Investigating accidents and injuries
- Keeping procedures current
- Passing on lessons learned
- Including safety is a line item in all SSRL based meetings

3.7 Specific Roles and Responsibilities

3.7.1 Line Managers

- Implement ISM as described within this Directorate-specific ISM Plan and provide all employees and non-employees (i.e., guests, sub-contractors, users and students) a safe workplace.
- Authorize projects and other work only in accordance with SLAC ES&H Policy, especially Chapter 2 – Work Authorization.
- Have frequent and structured dialogue with employees about safety that creates a safety culture:
  - Create and communicate ES&H expectations for each employee
  - Complete JHAMs and review AHAs pertaining to their work area (see Chapter 2 –Work Authorization). Note: These must be done jointly with employees as their involvement in safety integration and work planning is key
  - Specify training
  - Hold employees accountable for completion of required training and safe work performance
  - Make safety a prominent topic at “all hands” and staff meetings
  - Ensure safety aspects of each job are evaluated and that positions are filled only with candidates having adequate competency for the essential position responsibilities.
- “SLAC contacts” and UTRs assigned to non-employees generally have the same obligations as a supervisor:

- Require training for guests or sub-contractors appropriate to the hazards they will encounter. A graded and reasonable approach will be used.
- UTRs will always oversee sub-contractors and require training sufficient to assure safe operations and compliance with SLAC ES&H Policy.

3.7.2 Employees, Guests and Users

- Thoroughly understand and competently perform the five ISM Core Functions as steps to sustained safe work performance.
  1. Define work scope
  2. Analyze work for hazards
  3. Put in place controls that mitigate or eliminate hazards
  4. Do work within controls
  5. Continuous feedback and improvement of work practices to improve safety.

  No amount of safety documentation, work authorization, PPE, or controls can ever assure worker safety without each individual being personally responsible for safety. Workers must always keep the ISM Core Function five-step approach to working safely foremost in their minds as they conduct daily work at SLAC.
- Be knowledgeable of the Lab "Stop Unsafe Work Policy"
- Attend new-employee safety orientation training.

Additionally:

- Employees, in consultation with their supervisors, must complete the Job Hazards Analysis and Mitigation (JHAM) process and conduct a SLAC Training Analysis (STA) within 30 days of employment and fulfill all training requirements identified in their STAs. They must also demonstrate an understanding of the requirements of the ES&H Manual chapters applicable to the work they will perform.
- Sub-contractors must complete contractor-specific safety orientation and training (if required) before they perform any work.
- Users must complete the facility-specific safety orientation and training before beginning the "hands-on" portion of their experiment.
- Work can proceed only after line management has authorized it. Work can only be performed within controls specified by the JHAM or other work authorizations.

3.7.3 Safety Coordinators

- Directorate
  - Report directly to their Program Director, serve as the primary point of contact within their Directorate for all matters concerning the implementation of ISM and the Lab's ES&H policies.
  - Administer their Directorate ISMS program as described in the Directorate's ISM Plan.
  - Help maintain documentation required by the Directorate-specific ISM Plan and the SLAC Self-Assessment and Assurance Program (See Chapter 33).
  - Ensure proposed ES&H Policy is reviewed by key staff members within their directorate and comments are provided to the Policy's author.

- Support line management in identification, analysis, and control of hazards and stay abreast of changes within the Directorate.
- Schedule Directorate self-assessments, constitute peer review teams (see Chapter 33 – Self Assessment), and track deficiencies until closed out.
- Participate in external reviews.
- With the Program Director, help define roles of department and lower level Safety Coordinators
- Meet periodically with the ES&H Division management.

3.7.4 Others

- System Managers - Responsibility for individual accelerator systems falls to System Managers who are experts in their particular areas of responsibility. Engineering and technician support for the System Managers is provided primarily by the ETS and the sub-groups within it. While system managers direct the technical work on systems, supervisors in the support groups are responsible for organizing their workers' day-to-day activities, enforcing work standards and providing guidance in and assuring that safety requirements are met.
- Area and Program Managers - The roles of Area and Program Managers in accelerator operations are summarized in Chapter 4 of the SPEAR3 Safety Assessment Document.

  The program control responsibilities of the Program Manager include:

  - Manage the short-term schedule
  - Publish a detailed accelerator program and schedule for each day, determined with input from the Beam Line Program Manager and the Area Manager
  - Monitor the activities of the Accelerator Operators and provide assistance where needed
  - Attends the operations meeting each morning to review the progress of the previous day, announce schedule modifications, and gather resources as needed
  - Project the accelerator program goals and schedule
  - Report on the progress of the previous two weeks at the accelerator physics meeting

  The role of Program Manager is served by the head of the Operations group or his delegate during operation periods and by the head of the ETS group or his delegate during accelerator shut down periods.

  Area Manager responsibilities include:

  - Planning and coordination of maintenance activities
  - Oversight of the safety, workmanship, neatness, and documentation for all activities
  - Approval and distribution of the list of scheduled maintenance tasks
  - Initiation of Radiation Safety Work Control Forms when required
  - Assurance of the operability of all accelerator systems during operation and prior to turn-on

The role of Area Manager is served by the head of the ETS group or his delegate. During accelerator operations periods, the last two Area Manager responsibilities are delegated to the head of the Operations group or his delegate.

Beam Line Responsible Engineer/Physicist are responsible for individual beam lines. They are technical experts and have been trained in radiation and operational safety requirements. They are responsible for:

- Scheduling and coordinating maintenance activities and maintaining configuration control
- Initiating permits for activities that require them
- Assuring the operability of all beamline systems prior to turn on

Beam lines also have a number of **Beam Line Program Manager** whose function during operation periods is to be responsible for coordinating beam line activities with the responsible beam line engineer/physicist and the accelerator Program Manager.

3.8 Balanced Priorities

The Directorate conducts program-based budget planning which starts with development of the SLAC Basic Energy Science (BES) and Biological and Environmental Research (BER) Field Work Proposal (FWP) submissions to the Department of Energy Office of Science. The FWP discusses the current status of operations and research in the directorate. It also describes the short and long term plans for those activities as well as proposed experiments and facilities. The detailed planning proceeds by development of a budget with the program managers for the budget year. Preparation instructions are to incorporate within their requests, resources needed to support the people and materials for hazards identification and mitigation in their facilities and experiments and to assure safe and efficient operation. In summer, the planned budget is implemented at the appropriated level for the fiscal year beginning the following October.

Acronym List

AHA	Area Hazard Analysis
ASD	SSRL - Accelerator Systems Department
BER	Office of Basic Energy Research
BES	Office of Basic Energy Science
CCD	Charge Coupled Device
DOE	Department of Energy
ES&H	Environmental Safety & Health
ESRD	SSRL - Experimental Systems and Research Department
ETS	SSRL- Engineering Technical Service group
EWP	Electrical Work Plans
FWP	Field Work Proposal
GeV	Giga electron Volt
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
JHAM	Job Hazard Analysis and Mitigation
LCLS	Linac Coherent Light Source
LOTO	Lock Out Tag Out
LUSI	LCLS Ultrafast Science Instrumentation
NIH	National Institutes of Health
OSHA	Occupational Safety & Health Administration
PPE	Personal Protective Equipment
PSD	Photon Science Directorate
R&D	Research & Development
R&R	Roles & Responsibilities
RF	Radio Frequency
SAD	Safety Assessment Document
SLAC	Stanford Linear Accelerator Center
SME	Subject Matter Expert
SPEAR3	Stanford Positron Electron Asymmetric Ring (3rd generation)
SPPS	Sub-Picosecond Pulse Source
SSRL	Stanford Synchrotron Radiation Laboratory
STA	SLAC Training Assessment
URA	SSRL – User Research & Administration
UV	Ultra-Violet (light)
VUV	Vacuum Ultra Violet