



PARTICLE PHYSICS & ASTROPHYSICS

Integrated Safety Management (ISM) Plan

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This Plan was reviewed and approved by:

Persis Drell, Laboratory Director

Date

Steven Kahn, Program Director, PPA Directorate

Date

Annual Review and Update

Particle Physics and Astrophysics Directorate Integrated Safety Management (ISM) Plan

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

Steven Kahn, Program Director

Date

Frank O'Neill, ES&H Coordinator

Date

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

- *Added, 2008:* description of PPA's self-assessment efforts (Appendix A)
- *Added, 2008:* PPA's specific safety goals (Section I.C.)
- *Added, 2008:* mention of PPA's new work planning/control and lessons-learned programs (Section III.G.)
- *Updated, 2008:* acronyms, titles, names, status-of-projects, and org charts

Steven Kahn, Program Director

Date

Frank O'Neill, Directorate ES&H Coordinator

Date

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I. 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 ISMS Description
- 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 proved effective in protecting workers, the public, and the environment. This plan describes how:

- We integrate ES&H considerations into the planning and work of the PPA 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
 - Training and oversight
 - Personal Protective Equipment
- 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 ES&H Coordinators support the Directorate program and interrelate.
- Requests for programmatic funding include adequate resources to assure safety is integrated with program objectives and for ES&H support program implementation.

A. SLAC Mission and ES&H Policy

1. SLAC Mission

(see <http://home.slac.stanford.edu/welcome/mission.html>):

Photon Science Discoveries: *To make discoveries in photon science at the frontiers of the ultrasmall and ultrafast in a wide spectrum of physical and life sciences*

Particle Physics and 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 a safe laboratory that employs and trains the best and brightest, helping to ensure the future economic strength and security of the nation*

2. SLAC ES&H Policy

(see http://www-group.slac.stanford.edu/esh/about_esh/ESHpolicy.pdf for a complete description)

SLAC is committed to protecting the health and safety of on-site personnel, the public, and the environment as it carries out its scientific mission. Each of the laboratory's directorates is responsible for implementing the Environment, Safety and Health (ES&H) Program through line management. In addition, management at all levels is expected to ensure that all employees understand the content and importance of this ES&H Policy. In turn, employees are responsible for integrating ES&H considerations into their own work activities. The SLAC Director has ultimate responsibility for ES&H at the laboratory.

Through employee and management involvement SLAC will:

- Use our Integrated Safety and Environmental Management System to protect human health and the environment through:
 - Defining the scope of work
 - Identifying and analyzing the hazards
 - Developing and implementing hazard controls
 - Performing work safely
 - Soliciting and using feedback for continuous improvement
- Seek to maintain a healthful and safe workplace, free of recognized hazards and occupational injury and illness
- Wisely use and conserve natural resources and conduct our activities in a sustainable manner
- Conduct operations such that the production of radioactive materials and exposure to radiation is maintained as low as reasonably achievable

- Integrate environment, pollution prevention, safety, health and quality into project planning, design, construction, operations, maintenance, and decommissioning of facilities
- Ensure compliance with all applicable laws, regulations, and best management practices
- Put policies, programs and professional ES&H staff in place to ensure line management can carry out their responsibility for ES&H implementation

Workers have the authority and responsibility to stop, or not perform, any task when there is a reasonable belief that the task poses imminent risk of death or serious injury. In such a case, the workers must report this to their supervisor immediately.

SLAC recognizes the need to learn from successes and deviations from expected outcomes, and encourages workers to both report these instances and provide feedback. This is an essential part of our continuous improvement.

B. Particle Physics and Astrophysics Directorate Mission

The Particle Physics and Astrophysics Directorate conducts research in search of answers to fundamental questions about the ultimate structure of matter and the forces between these fundamental particles. Scientists use accelerators which speed electrons and anti-electrons to nearly the speed of light, and study their collisions and collisions from fixed target experiments. Using similar technology in astrophysics, space-based detectors will help us understand the birth and evolution of the universe.

C. Safety and Health Goals in the PPA Directorate

The PPA Directorate maintains the following safety and health goals for its workers:

	Metric	Responsible party	Goal
1	Percent of SLAC Training Assessments (STAs) Current	Directorate	94% starting in FY08
2	Percent of Mandatory Training Current	Directorate	94% starting in FY08
3	Percent of Required Medical Exams Current	Directorate	94% starting in FY08
4	Training No-shows	Directorate	<10/year
5	Percent of Building Evacuations ≤365 Days Old	Directorate Coordinators	100%
6	Percent of Facility Emergency Plans ≤365 Days Old	Directorate Coordinators	100%
7	Injuries, Total Recordable Cases (TRCs)	Directorate	<6/year
8	Cases requiring Days Away, Restricted Work, or Termination (DARTs)	Directorate	<2/year
9	First-aid Cases	Directorate	<10/year
10	Percent of management walkthrough inspections complete	Project leaders	100%
11	ORPS Corrective Actions completed	Various	95%
12	Percent of Corrective Actions in CATS Completed by Target End Date	Directorate Coordinators	95%

Directorate goals are as conservative as or more conservative than SLAC's aggregate goals.

II. ORGANIZATION, MANAGEMENT, AND RESPONSIBILITIES IN THE PARTICLE PHYSICS AND ASTROPHYSICS DIRECTORATE:

A. PPA Directorate Organization Chart

See http://www-group.slac.stanford.edu/ppa/Program/KAHN_ppadirectorate.htm .

B. Management Roles, Responsibilities, and Authorities

The roles, responsibilities and authorities for key ISM elements of the PPA Directorate are:

1. Director for Particle Physics and Astrophysics:
 - Lead the scientific mission for the lab's Particle Physics and Astrophysics programs
 - Communicate the Lab mission, strategy, and values for the Laboratory
 - Manage the development of facilities and equipment necessary to accomplish the PPA Directorate mission
 - Plan with Scientific Assistant Directors and Program Managers the resources needed to carry out the Directorate's program including all ES&H requirements
 - Effectively implement this ISM plan for the PPA Directorate.
 - Serve as member of the Lab Director's ES&H Coordinating Council
 - Investigate all high hazards or imminent danger situations to ensure that appropriate corrective actions and lessons learned are developed, implemented, and disseminated.
 - May act as Lab Director when the Director is unavailable
2. Deputy Director for Particle Physics and Astrophysics
 - Acts as PPA Director when the Director is unavailable
 - Oversees Engineering staff managers for the Directorate
 - Is assigned to the Lab Director for special assignments
 - Assistant Director for Administration and Operations
 - Coordinates and supervise directorate administrative support
 - Manages the PPA visitor programs
 - Reviews work in the directorate to ensure that all safety functions and checks have been completed before the PPA Director authorizes
 - Reports to the Director on all issues of ES&H

3. Staff Assistant Directors and Program Heads

- Participate with Program Managers in the negotiation with the Director for budgets for all the programs and departments in their division
- Are responsible for management of resources in the programs/departments in program division after developing the strategic direction with the Director
- Are responsible for implementing ISM into their programs/departments through defined roles and responsibilities, ES&H resource planning, work/experiment authorization

4. Directorate ES&H Coordinator

(see <http://www-group.slac.stanford.edu/ppa/safety.html>)

- Supports project and program managers to assure integration of safety from their conceptual stages through construction, operation, maintenance, and decommissioning.
- Together with a staff of facility safety engineers assists line managers in carrying out their responsibility to identify and mitigate hazards and obtain required approvals before commencing work
- Carries out oversight functions for the Director: coordinates walkthroughs, self-assessment, corrective actions, etc.
- Communicates with and supports other ES&H coordinators in the Directorate to assist in carrying out line managers responsibilities

5. Program Managers and Department Heads

- Are responsible for budget and personnel management for scientific programs
- Report to scientific ADs and participate in the negotiation for program budgets with the Director
- Supervise group leaders in the program
- Sit with other Department heads/program managers (under leadership of scientific program AD) and discuss strategic planning, resource management and program development
- In cases where a program is large enough to have departments under it, then the department heads in the program will report to the program manager
- Supervise program/department ES&H coordinator
- Ensure program follows all required assessment and review steps and authorizes work in the program

6. Supervisors/Group Leaders

- 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.

- Are responsible for performance evaluations and input into salary setting
7. Faculty
- Faculty advise lab management on how to invest its resources and on the long term scientific direction of the lab

III. INTEGRATION OF ENVIRONMENT, SAFETY, AND HEALTH INTO THE PARTICLE PHYSICS AND ASTROPHYSICS DIRECTORATE

Safety (to include all aspects of ES&H), 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, ES&H 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. The key ES&H policies for our Directorate and to which we are committed include:

- SLAC ISMS Description
- ES&H Manual
- Radiation Control Manual
- Guidelines for Operations

Line Management (to include directors, managers, and supervisors) is responsible and held accountable for incorporating these principles and ES&H Policy into the management of our work. Working safely is a condition of employment, and we cannot sustain our success unless all are committed to this end. Only in so doing will we ensure adequate protection of workers, the public, and the environment.

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 ES&H 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 ES&H 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.

In the PPA Directorate the principle of line management responsibility for safety is implemented through the 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 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 that facility Safety Assessment Documents are reviewed periodically and kept current, R&D projects have integrated hazard analyses, safety plans are developed and approved for major facility modifications, and daily operations incorporate safety planning
- Department heads, group leaders and supervisors work within SAD requirements, develop with their employees routine JHAMS, utilize non-routine JHAMS for unusual work, utilize work or experiment authorizations to assure procedures are followed by all participants
- 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

The PPA Directorate integrates ES&H into its program-based budget planning process which starts with the SLAC High Energy Physics Field Task Proposal submission to the Department of Energy for inclusion in the President's Budget to be submitted to Congress. The FTP describes the current status of research activities in the Directorate's facilities and the short and long term plans for those and proposed new experiments, R&D and facilities. The detailed planning proceeds by calling for a budget from the program managers for the coming fiscal year. The instructions are to include in their requests resources needed to support the people and materials for hazards identification and mitigation in their facilities and experiments. This budget call starts in July for the fiscal year beginning in October.

The PPA Directorate manages the facilities entrusted to it for the current programs, however there are sometimes infrastructure enhancements which are required to enhance

or maintain the laboratory's infrastructures, some of which are managed by the PPA Directorate. This infrastructure includes utility buildings, electrical infrastructure enhancement and replacement, building repairs and enhancements, environmental remediation, office remodeling, HVAC and cooling tower additions and replacement, etc. The PPA Directorate has the responsibility to propose infrastructure enhancements by submitting them to the Infrastructure Review Committee for prioritization and funding. The funds are held separately and managed formally with a risk-evaluation mechanism for balancing priorities through the Infrastructure Review Committee process. This process is the responsibility of the Chief Operating Officer. The laboratory wide infrastructure needs are balanced in this process.

A. Description of the PPA Directorate's Work Activities

The PPA Directorate's mission requires it to operate accelerator and experimental detector facilities, manage the scientific analysis and reporting of the output of these facilities, construct new accelerator and experimental equipment for particle physics and astrophysics, conduct R&D in the development of new techniques in the fields of particle acceleration, particle detection, data analysis, astrophysics, and cosmology, and studies the theoretical basis for observations in the field.

The accelerator and experimental facilities make up the largest part of the PPA activities which involve several hundred people organized to carry out the daily operations on a 24/7 basis for many months each year. The workforce includes nonemployees (SLAC Users) who spend time (from a few days to a few years) at SLAC and carry on tasks which are the same as employees. While at SLAC their work activities are managed directly or indirectly by SLAC.

Some work activities are conducted in research and development labs where activities vary significantly when new techniques are being tried to test new ideas for current and future research. These activities may include detectors, unusual gases, unique electrical systems and configurations, chemicals, mechanical structures, and software controlled systems.

B. Major Facilities in the PPA Division

The Lab Director has established clear lines of responsibility for all facilities through the lab deputy and associate directors. Facilities are required to have and maintain a Safety Assessment Document which describes potential hazards and mitigation systems to maintain a safe work environment. The Lab Director authorizes a facility for operations after a extensive reviews, including Accelerator Readiness Reviews, citizen committee reviews, Accelerator Safety Envelope assessments, and Accelerator Operations Audits. Reviews are conducted by inside and outside experts familiar with similar facilities.

The PPA Directorate manages several accelerator facilities, research and development labs, experiment manufacturing facilities and many office complexes at SLAC. This work environment contains a broad array of potential hazards which must be identified and controlled.

For the PPA Directorate the major facilities and responsible department are as follows:

- The Two Mile Linac (Accelerator Department)
- The PEP II Storage Ring (Not operating) (Accelerator Department)
- The Babar Detector at PEP II (Not operating) (Babar Collaboration Management)
- End Station A experimental hall (Not operating) (Test Facilities)
- The NLCTA accelerator research facility (Test Facilities)
- The SLAC Linear Collider (Not operating) (Accelerator Department)

The major office buildings are as follows:

- Central Laboratory and Central Laboratory Addition
- Research Office Building
- Kavli Institute for Particle Astrophysics and Cosmology

C. Inventory of Work Hazards

The PPA Directorate has a wide range of working environments with various potential hazards: radiation from high energy accelerators, unusual equipment in experimental halls and beam-lines, tunnel access hazards, industrial hazards in experiment manufacturing facilities, machine shop hazards, electrical hazards, chemical hazards, seismic hazards from large heavy equipment, and routine office area hazards.

The most significant hazards are in the accelerator and experimental facilities:

- Ionizing radiation
- Fall hazards from ladders and work on or near large equipment or tunnel access penetrations
- Static magnetic fields (for more information see <https://jlabdoc.jlab.org/docushare/dsweb/Get/Document-16418/6440.pdf>)
- Low and high voltage or current (electrical) hazards around equipment
- Tunnel access

- Narrow passageways and difficult equipment access
- Crane and lifting hazards
- Hazardous atmospheres including oxygen deprivation from inert gases
- Noise from loud equipment
- Machine shop and tool use hazards
- High pressure and vacuum vessels
- Seismic hazards from large equipment and buildings

Office areas have the usual hazards

- Ergonomics
- Seismic restraint of office furniture
- Trip and fire hazards from housekeeping issues
- Stairway and walkway use hazards
- Electrical services usage (extension cords, outlets)

The PPA Directorate continuously assesses its own activities and facilities to spot and address hazards before they result in injury or loss. See Appendix A for the *PPA Directorate Self-assessment Plan*.

D. Hazard Control Development and Implementation

Hazards are identified in the planning process for an experiment, facility, or operation. Once identified the hazard is controlled through:

- An engineered design for experimental or accelerator apparatus which controls the hazard
- Procedures which assure the engineered solutions are used
- For occasional or unusual hazards an administrative procedure is developed and used to control the hazard
- Routine JHAMs are used to assure that an individual uses appropriate controls for the hazards he encounters in his routine work activities
- Non-routine JHAMs are procedures which incorporate controls for non routine tasks

Controls are developed through use of the engineered designs and the following the developed procedures.

Examples of hazard controls in the PPA Directorate:

- Elimination of high-hazard systems
- Design of systems using low-hazard materials

- Use of fall restraint inertial reels in climbing on unusual experiment or accelerator apparatus
- Use of hazardous atmosphere detectors and alarm system around experiments with unusual gases
- Use of Personnel Protection System interlocks and procedures in radiation areas
- Operating procedures such as search procedures for PPS areas
- Electrical and mechanical interlocks on experimental equipment
- High-sensitivity fire detection systems, fire suppression and alarm equipment on densely-populated electronic installations

The hazard identification and controls are documented in different ways tailored to the size and complexity of the project and the potential for injury to personnel, damage to the environment, and damage to equipment and facilities.

Documents and activities that may be included in the safety effort for a project are listed below.

- Safety Assessment Document (SAD), DOE
- Accelerator Safety Envelope (ASE), DOE
- Accelerator Readiness Review (ARR), DOE
- Fire Hazard Analysis (FHA), DOE
- System Safety Engineering Program, NASA/various
- Integration and Testing Hazard Analyses, NASA/various
- Range Safety Documentation, Missile System Pre-launch Safety Package (MSPSP), NASA
- Citizen Committee Reviews, SLAC
- Bay Area Air Quality Management District (BAAQMD) Permit- analyses
- Project Safety Reviews - internal and external
- Outside expert-consultant reviews
- Safety participation in Project Design Reviews
- Subject Matter Expert participation
- Project Safety Plans
- Project Safety Teams
- Work oversight by safety personnel- up to 100% coverage when warranted
- Job Hazard Analysis
- Area Hazard Analysis

Understanding and categorizing the risk for large projects is necessary to efficiently manage that risk. Major modification and upgrades to projects may introduce new hazards or compromise established safety systems. Significant change to the design or operation of projects necessitates reviewing the hazard analysis for currency. All projects are reviewed when significant change in the design or operation occurs.

E. Work Planning and Control

In pursuing its mission the PPA Directorate operates facilities, conducts R&D, constructs accelerators and experiments and related equipment and analyzes data in the process of publishing scientific results. There are a variety of ways that work is authorized to ensure safety through consideration for the guiding principles and core functions of ISMS. The authorization level may be at the directorate level, program manager, department head or group leader or at the supervisor level as discussed below.

When the PPA Directorate proposes new initiatives, new experiments, new facilities, and substantial modifications to existing scientific facilities they are written as proposals and submitted to the Director who initiates review by the Experimental Program Advisory Committee for scientific merit. The safety impact is evaluated by the Director of the ES&H Division and his/her staff. The Director's decision to proceed with the project is based on the scientific merit as recommended by the program committee and an acceptable impact report assures that resources can be provided and that there are no unacceptable safety risks.

Once a new program element is approved by the Lab Director, he or she requires that it be sent to the SLAC Safety Overview Committee for referral to one or more of SLAC's ES&H Citizen Committees and Safety Officers for review and approval. These committees review the project and establish whether the new element's hazards have been adequately identified and controlled. Their approval establishes a basis for the PPA Director and line managers to authorize commencement of operations.

In some cases the Lab Director or the PPA Director may require a Readiness Review by external experts to establish both technical and safety readiness for operations. A successful Readiness Review enables the Director to authorize the commencement of operations. Appendix B has a history of the development of the Babar Detector to illustrate the integration of safety into a major experiment.

R&D activities are authorized by the program manager, group leader or supervisor based on their analysis of the potential hazards and providing appropriate controls based on the SLAC ES&H Manual and other policies and procedures which derive from the SLAC Work Smart Standards. They may be assisted in this analysis by their local ES&H coordinator, the PPA Directorate Coordinator, ES&H Division subject matter experts, Citizens Committees or sources outside of SLAC. Once the potential hazards are identified and controlled, the manager can authorize the activity to commence.

There are many activities in the routine operations of experiments and R&D that are well controlled by policies in the ES&H Manual but need to be planned and formalized because they are unusual - for instance an unusual experimental device being lifted by a crane and put into place. This requires a written non-routine JHAM (Job Hazard Analysis and Mitigation) plan. These are planned by the supervisor and the participating employees so that all may participate in the plan. The non-routine JHAM is used to authorize such work.

Authorization of routine work performed by all employees is tailored to their work environment through a formal interaction between the supervisor and the employee with consideration for hazards they routinely encounter. This may be an experimental or accelerator area where a Safety Assessment Document is used to assure a good understanding of potential risks. In smaller labs an Area Hazard Analysis must be done to identify potential hazards in the area. These may be addressed through training of equipment operations or provision of appropriate personnel protective equipment in the lab. JHAMs are updated annually and whenever the work task or environment changes.

A SLAC-wide system for work planning and control documentation is in development at the time of writing. The Directorate anticipates that the BaBar decontamination and decommissioning planned for late 2008 will be among the first efforts to use this new system.

F. Assurance of Work Controls

Control systems for experimental and accelerator system require competent and qualified people who are trained in their jobs and procedures in order to ensure that the controls will be used appropriately and properly. Management meetings on a weekly or daily basis are used to plan work and ensure that controls and procedures are used. Sometimes these are referred to as tailgate meetings which happen just before beginning an activity. The work authorization process is intended to ensure that hazards are planned and controlled for significant unusual activities.

The following mechanisms are used to ensure work is performed within controls in the PPA Directorate:

- Accelerator/experiment operations startup is controlled by the Beam Authorization Sheet (BAS) to assure that radiation safety control systems are in place and functioning
- Each morning during regular operations the Accelerator Department meets at 8am to review the past 24 hours operational experiences and plan operation activities for the next 24 hours.
- Each morning at 8:00 a.m. the BaBar Experiment crews meet to discuss their activities for the day and any unusual safety situations
- Each morning at 8:15 a.m. the accelerator maintenance crews meet to discuss their activities for the day and any unusual safety situations
- Each Monday at 9:30 a.m. the NLCTA organization meets to plan its activities for the week and discuss any usual safety hazards
- Experiments frequently hold “tailgate” meetings at the beginning of shifts
- Accelerator systems and experiment personnel frequently hold Repair-Opportunity-Day (ROD) planning meetings and the downtime planning meetings

G. 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.

The PPA Directorate participates in lab-wide self assessment programs annually. This has in the recent past consisted of a variety of programs conducted throughout the year which contribute to the overall self assessment report at the end of the fiscal year.

The PPA Directorate conducts regular walkthroughs of selected facilities attended by the PPA Director and/or the Deputy Director, the ES&H Coordinator, and the program-, facility-, or department manager. DOE Stanford Site Office personnel often accompany these walkthroughs. (See the *PPA Self-assessment Plan* in Appendix A for more information.)

As a member of the ES&H Coordinating Council the PPA Director reports quarterly on ES&H activities in the directorate including major operations planned and completed, walkthroughs done, progress towards annual goals.

Any accident must be reviewed by the PPA Director and steps taken to avoid repetition of the accident under similar circumstances. The Director is assisted by the Directorate ES&H Coordinator and the Deputy and Assistant Directors in these activities.

The PPA Director oversees the carrying out of corrective actions identified in Director's walkthroughs with the help of the Directorate staff.

PPA formally participates in the SLAC-wide Lessons-learned Program by regularly reviewing the SLAC Lessons-learned database (see <https://slacspace.slac.stanford.edu/sites/esh/cgs/ll/default.aspx>) for extent-of-need inside the Directorate. A PPA safety coordinator forwards applicable lessons to personnel responsible for similar systems, activities, or work environments. Responses from the PPA Directorate to each lesson are recorded in the Database.

The Directorate also formally participates in the SLAC Close-call Reporting Process to collect and share information on incidents that could have resulted in an injury, property damage, or release to the environment, thus allowing SLAC to identify and trend conditions that aid in the prevention of similar occurrences. See http://www-group.slac.stanford.edu/esh/concerns/close_calls/ for more information of the Close-call Program.

H. Specific Roles

1. Line Management

- a. 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.
- b. Authorize projects and other work only in accordance with SLAC ES&H Policy, especially Chapter 2 - Work Authorization.
- c. Supervisors will create and communicate ES&H expectations (see http://www-group.slac.stanford.edu/esh/about_esh/eshpolicy.htm) for each employee and
 - 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 crucial.
 - Specify safety and other training necessary to perform work within controls
 - 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 requisite competence
- d. “SLAC contacts” and UTRs assigned to non-employees have similar obligations to supervisors:
 - 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. (See Chapter 42 - Sub-Contractor Safety)

2. Employees, Users, and Guests

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 functions and principles to working safely foremost in their minds as they conduct daily work at SLAC. Employees, users and guests must

- a. Thoroughly understand and competently perform the five ISM Core Functions as steps to sustained safe work performance, viz.,
 - Define work scope
 - Analyze work for hazards
 - Put in place controls that mitigate or eliminate hazards
 - Do work within controls
 - Use continuous feedback and improvement of work practices to improve safety.

- b.** Be knowledgeable of the Lab “Stop Unsafe Work Policy” (See Chapter 2 - Work Authorization)
- c.** Attend new-employee safety orientation training (see Chapter 24 -Training).
- d.** Proceed with work only after line management has authorized work. Work only within controls specified by the JHAM or other work authorizations.
- e.** Additionally:
 - Employees, in consultation with their supervisors, must complete a Job Hazards Analysis and Mitigation form (JHAM) and conduct a SLAC Training Assessment (STA) within 30 days of employment and fulfill all training requirements identified in their SLAC Training Analysis. (See Chapter 24 - Training.) 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.

Some of the PPA Directorate facilities are operated as DOE user facilities for the benefit of international scientific collaborations. The users vary in the level of participation from internet access only, a two-week visit per year to participate in the facility operation, and full-time residency and working alongside employees. It is required that the collaboration spokesperson defines the levels and types of participation and develops a plan for appropriately supervising their activities with ISM. In many cases the user will be treated the same as the employee with a defined SLAC contact who looks after the ISM requirements. Typically a user who comes for fewer than 30 days per year and does not participate in facility operation is treated as a visitor, i.e., a desk worker.

3. ES&H Division

The ES&H Division shall enable the Laboratory to achieve and maintain excellence in matters related to environment, safety, and health by:

- a.** Providing SLAC management and staff with the support and training necessary to:
 - Ensure a safe and healthy workplace.
 - Minimize adverse impact to the general public.
 - Minimize adverse impact to the environment.
 - Ensure compliance with all applicable laws, standards, and regulations governing environment, safety, and health.
- b.** Providing leadership to develop and implement programs that improve ES&H performance.
- c.** Anticipating future ES&H risks and requirements that may affect SLAC.

4. Citizen ES&H Committees

- Ensure the ES&H hazards of major or significant new activities (experiments, projects, test beams, facility construction, or facility modifications) are adequately analyzed and

- will be adequately controlled, and that a planned activity conforms to ES&H policy and requirements.
- Issue a formal approval to the activity proponent when it concludes the hazard analysis is adequate, hazards will be sufficiently controlled, and that the activity conforms to ES&H policy.
 - Advise the laboratory director on subject matter pertaining to its area of expertise
 - Assist personnel in evaluating hazards when requested
 - Interpret industry standards in conjunction with ES&H Division and safety officers
 - Review accelerator facility procedures
 - Verify that design processes comply with safety regulations
 - Stopping unsafe activities. The chairperson of each citizen committee has the authority to top any unsafe activity that 1) presents an *imminent hazard* (as defined in Chapter 2, “Work Authorization”) and 2) is within the area of responsibility of the chairperson’s citizen committee.

I. Balancing Priorities

The Directorate includes in the budget planning process the identification of resources to identify, mitigate, implement and improve safety systems for the facilities it operates and research activities it conducts. Project safety is funded directly by each project. Small projects of less than \$25K are funded through the PPA Directorate budget process. Substantial infrastructure projects (>\$25K) in the facilities managed by the PPA Directorate are submitted to the ADS process for prioritization and then funding is determined by the COO using the Infrastructure Review Committee. The Directorate ES&H Coordinator and staff are empowered to spend funds in direct support of the assistance they provide to line managers.

APPENDIX A

PPA Directorate Self-assessment Plan

Overview

This plan offers a systematic approach for the self-assessment of SLAC Particle Physics and Astrophysics Directorate (PPA) projects and facilities pursuant to the requirements of *the SLAC Environment, Safety, and Health Manual* Chapter 33, “Line Management Self-assessment.”

The PPA Directorate engages in the following self-assessment activities:

- **Inspections and assessments.** Performing, documenting, and tracking findings from regular walkthrough inspections and work activity assessments to promote safe conditions in PPA workplaces
- **Document Reviews.** Periodic writer and stakeholder reviews of PPA safety documents, including Safety Assessment Documents (SADs), Hazard Analyses, written procedures, safety plans, Job Hazard Analysis and Mitigation (JHAM) and Area Hazard Analysis (AHA) documents, and other standing safety documents
- **Metrics tracking.** Monitoring accident/injury (TRC/DART) rates, training completion, and other safety-related data over time to spot and address trends
- **Oversight.** Direct monitoring of major activities by PPA safety professionals.
- **Feedback.** Use of event and lessons-learned reporting to promote constant safety improvement

Those responsible for performing PPA self-assessment activities are divided into three groups:

- **Projects.** Project (e.g. BaBar, GLAST, Accelerator Research) managers are responsible for performing Line Manager Walkthrough Inspections, Line Management ES&H Compliance Assessments, and regular reviews and updates of safety documents.
- **Facilities.** Facility, building, and area managers are responsible for updating AHAs annually and whenever building, system, or facility conditions see changes that could affect safety. Building managers are required to update Facility Emergency Plans and perform building evacuation drills at least once annually for buildings housing ten or more workers. Building managers are also to inspect their buildings annually as required by the Building Manager Program.

- **General.** Workers and their supervisors are responsible for annual routine JHAM, SLAC Training Assessment, and Lockout/Tagout Equipment Lockout Plan (ELP) updates. (See http://www-group.slac.stanford.edu/esh/hazardous_activities/lockout_tagout/CoHE.pdf). PPA Safety Coordinators perform Occurrence Reporting and Processing System (ORPS) investigations, provide and distribute safety lessons learned to PPA workers, annually review a random sample of 10% of PPA JHAMs, track safety metrics, and provide direct safety oversight to large project activities. The PPA Director performs annual upper-level management walkthrough assessments of all projects.

Project Self Assessment

Hazards and the associated risks in PPA projects vary greatly. Safety effort is appropriately tailored to the projects, and self-assessment is similarly tailored. For this reason, projects with significant hazards, dollar-value, mission-criticality require a formal systems-safety engineering effort. This may include safety coordinator participation during design, extensive safety coordinator oversight during construction and upgrade activities, safety involvement in operations, and formal safety analysis documentation (SADs, Preliminary Hazard Analyses, Fire Hazard Analyses, Operation and Support Hazard Analyses, NASA Missile System Pre-launch Safety Packages, etc.) High-level documents required for each project's startup are specified by the DOE and other organizations (e.g.: NASA, NOAO, SLAC Safety Overview Committee) during the project's planning stages. Safety for operations of smaller scope may be covered in work procedures, checklists, and similar lower-tier documents.

Updating and maintaining the currency of all safety documents is essential in preventing personal injury and property damage, thereby protecting the SLAC mission. Safety Assessment Documents must be reviewed and updated every two years and when changes to systems or facilities could impact safety. All other safety documents must be reviewed and updated at least every three years. Inactive documents must be reviewed and updated before being reinstated.

2. Safety Inspections and Assessments

PPA Director/Senior-management Walk-through Assessments

The PPA safety coordinator schedules and performs walk-through inspections led by the PPA Director at least once each year. Such assessments engender a sense of concern for worker safety through the entire line, and as such are focused more on worker activities than on workplace conditions. Discussion of worker concerns, recent accidents, ES&H Division initiatives, DOE reviews and findings, upcoming audits, JHAMs, AHAs, training status, and administrative controls also allows PPA senior management and front-line workers to exchange important safety information face to face.

The safety coordinator or designee documents these assessments using the form specified in ES&H Manual Chapter 33 and the Corrective Action Tracking System (CATS) and documents walkthroughs with the Safety Management Records Tool (SMART) database even in the absence of findings. PPA Senior management uses information gathered during these assessments in its *Annual Directorate ES&H Self-assessment and Report* to the ES&H Coordinating Council. Imminent-danger situations are immediately addressed, and workspace managers are responsible for correcting lesser deficiencies and restricting access to areas posing imminent danger to workers until the deficiency is corrected. Furthermore, the PPA Director reports pervasive or insidious imminent-danger situations or behaviors noted during assessments to the SLAC Director.

Line Management Walkthroughs

At least once per year, an upper-level manager for each PPA project must engage project workers in how they do their work safely by performing a formal Line-management Walkthrough. Findings are recorded and tracked in CATS, and the walkthroughs are documented in the SMART database even in the absence of findings. During such walkthroughs managers ask questions about basic worker safety, use of and adherence to procedures, use of personal protective equipment, and other topics pertaining to safe work. Managers should use a graded approach to their inquiries, so high-hazard tasks are more closely scrutinized than low-hazard ones. Workers should be asked about their JHAMs, safety training, and work practices. Managers should seek ideas from the worker about how to make the job safer, and workable ideas should be documented in CATS. Managers should call on PPA safety coordinators to support inspection activities and document any findings.

Line Management-led ES&H Compliance Assessments

At least annually, line managers in each PPA project must perform and document an assessment of how well the project adheres to its own procedures and how fully the workplace conforms to SLAC safety standards by performing a Line Management-led ES&H Compliance Assessment. Managers may use a checklist (provided as an appendix to *ES&H Manual* Chapter 33) to help verify compliance with SLAC workplace safety standards, however, the assistance of a PPA safety coordinator to support this activity is greatly encouraged. Assessment findings are documented in CATS, and a record of the assessment itself is made to SMART. It is recommended that PPA safety coordinator enter Assessment findings. Managers may perform Line Management-led ES&H Compliance Assessments and Line-management Walkthroughs simultaneously.

Enlist the aid of others in performing any line-management walkthroughs and assessments. Front-line supervisors should be employed to explain the work, systems, facilities, and hazard controls. A PPA safety coordinator can make quick

determinations on compliance issues and propose solutions to safety problems. ES&H Division subject-matter experts should be utilized when appropriate.

Documentation

Findings from Line-management Walkthroughs and ES&H Assessments must be recorded in the SLAC Corrective Action Tracking System (CATS), and a record of the assessment itself made to SMART. It is recommended that managers submit assessment and walkthrough findings to a PPA safety coordinator for CATS and SMART entry. Reminders for closeout of corrective actions recorded in CATS are emailed to responsible parties upon entry into the system and periodically thereafter. Managers who choose not to employ a PPA safety coordinator to enter findings into CATS and SMART will be asked to provide walkthrough documentation to a coordinator annually.

Facility Self Assessment

Building- and area managers must update Area Hazard Analyses (AHAs) for areas under their purview at least once each year. Submit AHA updates to a PPA safety coordinator for submittal to the web-based SLAC AHA library. PPA safety coordinators log and track AHAs for all PPA areas.

Annual building-manager walkthroughs are required by the SLAC Building Manager Program. Managers may perform Building Manager Walkthroughs concurrently with Line Management-led ES&H Compliance Assessments and Line-management Walkthroughs. Findings from these walkthroughs are recorded in the Corrective Action Tracking System (CATS). Building managers are asked to submit findings to a PPA safety coordinator for CATS entry. A PPA safety coordinator logs and tracks all PPA Building Manager Walkthroughs.

The *SLAC ES&H Manual* Chapter 37 requires building managers of PPA-owned buildings consistently housing ten or more workers or program-critical operation or system must prepare and annually update a Facility Emergency Plan. Furthermore, managers of buildings housing ten or more workers must perform an annual evacuation drill of the building(s). A PPA safety coordinator logs and tracks all PPA Facility Emergency Plans and building evacuation drills.

General Self Assessment

Direct Project Oversight

When warranted due to increased project risk, additional measures are put in place to augment the focus on safety. (BaBar maintenance periods and the Final Focus Test Beam Preservation are examples of such projects.) The PPA safety coordinator arranges to have major projects involving heavy construction and/or decommissioning, simultaneous work by many (often non-PPA) groups, or extreme

hazards placed under constant monitoring by safety professionals. These professionals comprise a safety team under the leadership of a single safety professional. Safety team members attend pre-shift meetings during such projects and bring word of noted deficiencies and good practices to all project working groups. The safety team also assists in the preparation of Non-routine Job Hazard Analyses with workers unfamiliar with the often strange work environments, distributes and helps deploy personal protective equipment, and performs training to address building- or system-specific hazards. Safety team members review lessons learned from past higher-risk projects for use on future projects.

SLAC Training Assessments and Job Hazard Analysis and Mitigation Document Reviews

Each PPA worker reviews his or her SLAC Training Assessment (STA) and routine Job Hazard Analysis and Mitigation document (JHAM) with their supervisor during the worker's annual performance evaluation. Workers and supervisors are also responsible for updating their Lockout/Tagout ELPs annually or when changes to systems warrant. Additionally, PPA Safety Coordinators annually review a random sample of 10% of PPA routine JHAMs for completeness and applicability.

Accelerator Operations Safety Reviews

The Safety Overview Committee chairperson facilitates safety audits for each accelerator facility with assistance from SLAC-wide representatives with appropriate expertise. Each SLAC accelerator facility is audited at least once every five years. All such reviews contain

- Assessment of the facility's safety systems
- Assessment of compliance with SLAC safety policies and procedures
- Evaluation of safety training programs and records
- Evaluation of conduct of operations

Documentation consists of audit reports provided to the Environment, Safety, and Health Coordinating Council.

Metrics Reporting

PPA safety coordinators report the following safety metrics to the ES&H Coordinating Council quarterly:

- Total recordable injury cases and injury-related days away, restricted-duty, or transferred (TRCs and DARTs)
- (SLAC Training Assessments) STAs and mandatory training and medical-monitoring completion rates
- Status of annual Facility Emergency Plan updates
- Status of annual evacuation drills of occupied buildings

- CATS (Corrective Action Tracking System) finding closure rates

PPA safety coordinators also report the following self-assessment information to the PPA Director and ES&H Coordinating Council annually:

- Summary of self-assessment activities and issues found in walkthroughs and assessments
- Summary of CATS entries, open items, and trends
- Summary of Performance against ISMS Measures
- Summary of ISEMS Effectiveness
- Areas for Future Focus

APPENDIX B

The History of Safety Planning at BaBar - 1994 to Present

The following is an example of major facility safety planning as it is done in the PPA Directorate.

Babar is a large particle detector which resides in the PEP II B Factory ring. The safety effort for the BaBar program began at the conceptual stage (1994) with assignment of one of the senior physicists to the role of Babar Integration Physicist whose role included overseeing the safety analysis and design planning for the detector. (When operations began this position became the Safety Physicist.) In addition an experienced, professional Safety Officer (system safety engineer) was hired to the program to manage the required processes for identifying and designing safety into the subsystems of the detector. The safety officer became a member of the BaBar Technical Board and thus was aware of and involved in decisions related to the basic design. A BaBar Safety Group was established which consisted of: the BaBar Safety Officer, the appointed safety coordinator for each major detector system, the Project Chief Engineer, and the physicist responsible for detector integration. The process of identifying hazards, assessing risk, and eliminating or reducing the risk to acceptable levels has been conducted in a systematic way throughout all phases of the BaBar program including: concept, design, construction, operation, and modification and upgrades.

The BaBar detector is located at Interaction Region (IR) -2 of PEP-II. The hazards associated with the project not typically encountered in industry are: flammable gases, cryogenics, radiation, and large magnetic fields. The more conventional hazards are: electrical, fire, earthquake, occupational, pressure, and hazardous material.

The safety effort for the BaBar detector project included the following in the approximate order of occurrence:

- The initial review and assessment of design hazards was reported in the safety chapter of the BaBar Technical Design Report
- The hazard classification determination was assigned by the DOE
- The assistance of a fire protection specialist (consultant) was procured to provide expert advice on the development of a minimum fire rating requirement for the type of wire and cable utilized in the detector
- Multiple internal design safety reviews
- The development of a Preliminary Safety Assessment Document and DOE approval
- The development of the Final Safety Assessment Document and DOE approval (and subsequent Addendum)

- The assistance of a fire protection specialist (consultant) in analyzing the LEL of three part gas mixtures and conducting testing to determine ignition and flame propagation characteristics of proposed materials
- The development of a Fire Hazard Analysis and DOE approval (and two subsequent addendums)
- An independent review of the BaBar safety analysis and safety systems
- SLAC Citizen Committee Reviews
- Bay Area Air Quality Management District (BAAQMD) permit/approval to emit Hazardous Air Pollutants (HAP) and Precursor Organic Compounds (POC)
- Development of Safety Plans in order to address unique risks associated with major detector modification activities,
- Lessons-learned Meetings

After all the safety reviews and approvals were met, the facility was authorized to begin operations in 1999. The safety roles described above have continued to oversee the operations and modifications to the detector. In 2004 there was a major intervention where the detector was partially dismantled to replace failing components with new. This was done with a carefully developed and fully reviewed and authorized LST Safety Plan in August-October, 2004. A similar intervention took place in the summer of 2006 to replace additional detectors.

APPENDIX C:

History of the Gamma Ray Large Area Space Telescope (GLAST) Safety Plan

GLAST is an orbital gamma-ray observatory launched in June 2008. PPA undertook the construction, integration, and testing of the chief GLAST system: the Large Area Telescope (LAT).

Safety of the LAT system, its test articles, and test personnel was of primary concern in all I&T test activities. Safety awareness was built into all phases of integration and testing (I&T). Safety was an agenda item at the LAT Daily I&T Coordination meetings every morning and afternoon. I&T test methods and procedures were developed, documented and executed to ensure that the LAT I&T personnel, the LAT instrument and its test articles were in no danger due to improper handling, lifting, erroneous wiring, electrostatic discharge, contamination, power or operational problems. The details of the I&T safety plan are documented in LAT-MD-01376, LAT I&T Test Plan. It includes the LAT I&T safety plan, personnel safety, and LAT flight hardware as it relates to LAT I&T activities.

In support of LAT safety activities, PPA Safety Coordinators prepared and submitted three formal hazard analyses to NASA and the DOE:

- LAT-MD-00366 *LAT Preliminary Hazard Analysis*
- LAT-MD-01968 *LAT Operating and Support Hazard Analysis*
- LAT-MD-08146 *LAT Environmental Test Hazard Analysis*
- LAT-TD-08825 *LAT EWR-127 Detailed Compliance Matrix*

The SLAC Job Hazard Analysis and Mitigation (JHAM) process was used broadly for integration procedure development and execution. The JHAM was included in pre-test briefings, held by the Mechanical or Electrical I&T Lead. The pre-test or pre-task briefings were utilized to review operations and test processes, prior to execution, to communicate potential risk areas and review the safe operating steps included in the procedure.

All Integration and Test personnel were provided training per the GLAST LAT System Safety Program Plan, LAT-MD-00078. All I&T personnel were trained in Employee Orientation in Environmental Safety and Health (ES&H) and General Employee Radiological Training (GERT), provided by SLAC. In addition, the LAT project requires contamination-control, electrostatic-discharge, and oxygen-deficiency training.

The LAT Safety Program was specifically intended to assure continued compliance with the SLAC ESH-100 and Occupational Safety and Health Act (OSHA) safety regulations and directives. Safety surveillance was maintained through the program to point out any

conditions that could present hazards to personnel or equipment. This surveillance was the responsibility of the LAT Integration Facility manager, the I&T manager, the SLAC Environmental Safety and Health (ES&H) representative, LAT QA, and the entire LAT team. In addition to the continuous monitoring of the facility, an organized monthly safety walkthrough was performed by the facility manager and the SLAC ES&H representative. Findings were documented in compliance with the SLAC ES&H guidelines and sent to the appropriate manager for resolution.