Independent Assessment of Work Planning and Control at the SLAC National Accelerator Laboratory

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U.S. DEPARTMENT of ENERGY | Office of Enterprise Assessments

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Acronyms

AHA	Area Hazard Analysis
ATA	Activity and Training Authorization
Cal/OSHA	California Department of Industrial Relations, Division of Occupational Safety and Health
CAS	Contractor Assurance System
CFR	Code of Federal Regulations
CRAD	Criteria and Review Approach Document
CUIR	Critical Utilities Infrastructure Revitalization
DEAR	DOE Acquisition Regulation
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
ESH	Environment, Safety, and Health
F&O	Facilities and Operations
HVAC	Heating, Ventilation, and Air Conditioning
IAS	Integrated Assessment Schedule
IH	Industrial Hygiene
IIPP	Injury and Illness Prevention Program
ISM	Integrated Safety Management
JSA	Job Safety Analysis
LCLS	Linac Coherent Light Source
LEIT	Low Emittance Injector Tunnel
LOTO	Lockout/Tagout
NFPA	National Fire Protection Association
OFI	Opportunity for Improvement
PJB	Pre-job Briefing
PPE	Personal Protective Equipment
PRCS	Permit Required Confined Space
QAP	Quality Assurance Program
RWP	Radiological Work Permit
SCAS	*Stanford University's Contractor Assurance System for the SLAC National Accelerator Laboratory* (document)
SDS	Safety Data Sheet
SLAC	SLAC National Accelerator Laboratory
SSO	SLAC Site Office
SU	Stanford University
WCD	Work Control Document
WP&C	Work Planning and Control

INDEPENDENT ASSESSMENT OF WORK PLANNING AND CONTROL AT THE SLAC NATIONAL ACCELERATOR LABORATORY

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of work planning and control (WP&C) at the SLAC National Accelerator Laboratory (SLAC) from February to April 2026. Stanford University manages and operates SLAC for the DOE Office of Science. The assessment focused on elements of SLAC's implementation of the integrated safety management (ISM) core functions (define the scope of work, identify and analyze hazards, develop and implement hazard controls, perform work within controls, and provide feedback and continuous improvement). The assessment also evaluated the effectiveness of Stanford University's contractor assurance system (CAS) and flowdown of safety and health requirements to subcontractors.

EA identified the following strengths:

- SLAC's pilot ergonomics program involving Facilities and Operations mechanics and the Occupational Health Center provides a preventive approach to ergonomic hazards by combining education and training with medical oversight and physical training.
- Integration of Environment, Safety, and Health (ESH) coordinators, construction managers, and safety coordinators into contractor/subcontracted construction projects provides added assurance that work is being performed safely.
- SLAC's procurement process effectively flows down safety and health requirements, including WP&C and ISM, through SLAC's injury and illness prevention program and the ESH Manual to contractors and subcontractors.

EA also identified several weaknesses, as summarized below:

- SLAC has not developed a required systematic change control process for modifying work control documents, such as job safety analyses, area hazard analyses, forms, and permits.
- Several WP&C implementation deficiencies were noted in the ISM core functions of identifying and analyzing hazards, developing and implementing controls, and performing work within controls.
- CAS-related issues were identified associated with policy and program documentation clarity, the frequency of WP&C programmatic self-assessments, the collection of lower-level issues, causal analysis, the use of metrics by front line managers, and post-job feedback.

In summary, SLAC's injury and illness prevention program and ESH Manual establish a generally adequate WP&C framework to support the implementation of the ISM core functions and the safe performance of work. SLAC's pilot ergonomics program provides a preventive approach to ergonomic hazards among Facilities and Operations mechanics. Additionally, SLAC effectively flows down safety and health requirements to contractors and subcontractors, and ESH coordinators assigned to each laboratory directorate and at subcontractor work sites provide added assurance that work is being conducted safely. However, weaknesses were identified in implementing some ISM core functions: identifying and analyzing hazards, developing and implementing controls, and performing work within controls. Additionally, some issues associated with the CAS were identified. Until the concerns identified in this report are addressed, or effective mitigations are put in place, some workplace hazards may not be properly identified and/or controlled, resulting in reduced protection of worker safety and health at SLAC.

INDEPENDENT ASSESSMENT OF WORK PLANNING AND CONTROL AT THE SLAC NATIONAL ACCELERATOR LABORATORY

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Worker Safety and Health Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of work planning and control (WP&C) at the SLAC National Accelerator Laboratory (SLAC). Stanford University (SU) manages and operates SLAC for the DOE Office of Science. This assessment was requested by the SLAC Site Office (SSO) and was conducted from February to April 2026.

In accordance with the *Plan for the Independent Assessment of Work Planning and Control at the SLAC National Accelerator Laboratory, December 2025*, this assessment evaluated SLAC's established WP&C processes and implementation of the five core functions of integrated safety management (ISM). DOE's ISM policy defines the following five core functions to ensure systematic and effective WP&C: define the scope of work, identify and analyze hazards, develop and implement hazard controls, perform work within controls, and provide feedback and continuous improvement. The assessment also evaluated the effectiveness of SU's contractor assurance system (CAS) as it relates to WP&C and flowdown of worker safety and health requirements to subcontractors performing work at SLAC.

SLAC is a research and development laboratory in Menlo Park, California, with a mission to design, construct, and operate state-of-the art accelerators and related experimental facilities for use in high-energy physics and synchrotron radiation research. SLAC activities involve various potential hazards which must be effectively managed to protect workers' safety and health. These hazards include exposure to radiation, lasers, hazardous chemicals, and various physical hazards associated with accelerator facility operations, maintenance, and construction activities (e.g., heavy equipment operation, trenching and excavating, electrical work, hot work, elevated work, and hoisting and rigging).

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which EA implements through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. This report uses the terms "best practices, deficiencies, findings, and opportunities for improvement (OFIs)" as defined in the order.

As identified in the assessment plan, this assessment considered objectives and criteria from DOE Guide 226.1-2A, *Federal Line Management Oversight of Department of Energy Nuclear Facilities*, appendix D, *Activity Level Work Planning and Control Criterion Review and Approach Documents with Lines of Inquiry*. In addition, EA used selected objectives and criteria from the following EA CRADs:

- EA-30-01, Rev. 2, *Contractor Assurance System*
- EA-30-09, Rev. 0, *Occupational Radiation Protection Program*
- EA-32-03, Rev. 1, *Industrial Hygiene Program*
- EA-32-11, Rev. 0, *Control of Hazardous Energy (Lockout/Tagout)*
- EA-32-12, Rev. 0, *Material Handling Safety*
- EA-32-13, Rev. 1, *Electrical Safety*
- EA-32-17, Rev. 0, *Cranes and Hoisting and Rigging Operations*.

EA examined key documents, such as system descriptions, work control documents (WCDs), procedures, manuals, analyses, policies, and training and qualification records. EA also interviewed key personnel responsible for developing and executing the associated programs; observed 86 work activities, including preventive and corrective maintenance, material handling, construction, pre-job briefings (PJBs), and safety inspections; and attended various committee meetings. The members of the assessment team, the Quality Review Board, and the management responsible for this assessment are listed in appendix A.

There were no previous EA findings to follow up on during this assessment.

3.0 RESULTS

3.1 Work Planning and Control Institutional Programs

This portion of the assessment evaluated SLAC's WP&C institutional programs and processes that implement worker safety and health program requirements to support the safe performance of work.

SLAC has established a generally adequate worker safety and health program to support the safe performance of work through SLAC-I-720-0A21B-001, *SLAC Injury and Illness Prevention Program* [IIPP], a comprehensive description document. The IIPP is implemented through an extensive collection of work instructions contained in SLAC-I-720-0A29Z-001, *SLAC Environment, Safety, and Health* [ESH] *Manual*. To accommodate subcontractors, who are well acquainted with the California Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA) regulations but not with 10 CFR 851, *Worker Safety and Health Program*, SU sought a permanent variance. In 2019, DOE granted SU this variance from portions of 10 CFR 851 (subparts B and C, and appendix A), which are covered by Cal/OSHA regulations and requirements within the IIPP; oversight and enforcement of the implementation of Cal/OSHA and the IIPP remains with DOE. The SU variance proposal appropriately includes a crosswalk to document implementing mechanisms for each requirement.

SLAC has established and implemented generally adequate work control and hazard identification processes through the ESH Manual; however, several weaknesses are discussed in this section and section 3.2. ESH Manual, chapter 2, *Work Planning and Control*, section 1.1, adequately addresses the seven guiding principles and five core functions of ISM. The *Hazard Control Selection and Management Requirements* (ESH Manual, chapter 1, *General Policy and Responsibilities*), section 3.1, appropriately prioritizes hazard elimination or substitution, followed by engineering controls, administrative controls, and personal protective equipment (PPE). The *Work Planning and Control Procedure* (ESH Manual, chapter 2), section 2.2, provides a ranking system based on work complexity and location (green, yellow, or red work in resident or non-resident areas[1]). For high-consequence work, the *Enhanced Rigor Work Planning and Control Procedure* (ESH Manual, chapter 2), section 2.3.1, appropriately mandates additional controls, including process failure modes and effects analysis. The *Stop Work Procedure* (ESH Manual, chapter 2) appropriately empowers workers to halt operations if there is an imminent threat (or pause work for a non-imminent threat) to safety, the public, the environment, or property. In addition, ESH coordinators, assigned to each laboratory directorate, provide added assurance that work is being conducted safely, and were actively engaged in safety oversight, including at subcontractor work locations.

SLAC has established and implemented a generally adequate process to identify and control industrial hygiene (IH) hazards. The IH program includes 15 chapters in the ESH Manual that address the types of IH hazards present at SLAC. Each hazard-specific chapter provides comprehensive roles and

[1] A resident area is an area where a worker performs much of their day-to-day activities and where the supervisor typically has authority to release work.

responsibilities and references other documents that provide more detailed instructions, such as for ventilation, PPE, and eyewash/showers. Using ESH Manual, chapter 2, work planners integrate requisite IH hazard controls as specified in the hazard-specific chapters of the ESH Manual. SLAC maintains a comprehensive IH equipment database that lists calibration due dates, a practice that supports the proper tracking of calibration. Furthermore, SLAC has initiated a pilot ergonomics program involving Facilities and Operations (F&O) mechanics and the Occupational Health Center. This program provides a preventive approach to ergonomic hazards by combining education and training with medical oversight and individual strength-training and stretching programs for the workers.

SLAC has established and implemented an adequate radiation protection program. ESH Manual, chapter 9, *Radiological Safety*, references the *Radiological Control Manual*, chapter 3, parts 1 and 2, which adequately address work planning requirements for radiological work. FO-005, *Radiological Work Permits* [RWPs] *Procedure*, provides appropriate direction to prepare, issue, control, and renew or close RWPs, which are used as the administrative mechanism to provide written authorization to control entry into and govern performance of radiological work. The RWP procedure appropriately incorporates the documentation of feedback upon completion of work or when an RWP is closed and requires the use of feedback and improvement and lessons learned information during RWP preparation. Reviewed records and interviews confirmed that several Radiation Protection Department members hold advanced degrees and/or professional certification from the American Board of Health Physics, ensuring a high level of expertise in radiation protection.

While SLAC has adequately addressed ISM in its work control and hazard identification processes, the following weaknesses were identified:

- Contrary to DOE Acquisition Regulation (DEAR) 970.5223-1(e), SLAC has not developed a required systematic change control process for modifying WCDs, such as job safety analyses (JSAs), area hazard analyses (AHAs), forms, and permits. (See **Deficiency D-SLAC-1**.) Not having a formal change control and reapproval process for revised WCDs has resulted in work being performed with unapproved WCDs, posing potential risk to workers. Several WCDs and forms observed to be available for use in the field were outdated or contained inaccurate information. For example:
    - Four construction subcontractor JSAs were used to govern discrete radiological work scopes on the Critical Utilities Infrastructure Revitalization (CUIR) project. None of the JSAs properly documented the presence of a radiological hazard or controls (see section 3.2 for further discussion). Interviewed personnel explained that, in response to a Radiation Protection Department staff member inquiry regarding not identifying radiation as a hazard (with associated controls) in the JSA, a SLAC construction manager modified the JSAs with a vaguely worded pen-and-ink change to add a work step and note the radiation hazard. However, due to the lack of a formal change control process, the revised JSA was not subject to review and reapproval by the individuals who approved the original JSA.
    - The *Area Hazard Analysis Procedure* (ESH Manual, chapter 2) requires an annual review of AHAs, but SLAC has not documented or tracked such reviews. A demonstration of the AHA library database revealed outdated AHAs, including for areas that have been repurposed or are no longer in use, and changed area/building manager contacts; some AHA revisions were more than 10 years old.
- SLAC has not performed a formal baseline IH hazards exposure assessment or identified similar exposure groups for improved understanding of exposure profiles to support sampling efficiency, sampling frequency determination, and trending. Consequently, most sampling is performed in response to requests rather than a site-integrated exposure assessment. (See **OFI-SLAC-1**.) The current IH staffing level makes it challenging to create and maintain a robust exposure assessment

program while also managing IH programs, maintaining IH equipment, and fulfilling sampling requests. (See **OFI-SLAC-2**.)

Work Planning and Control Institutional Programs Conclusions

SLAC's IIPP and ESH Manual adequately establish WP&C policies, requirements, and procedures to implement the ISM guiding principles and core functions. ESH coordinators assigned to each laboratory directorate and at subcontractor work locations provide added assurance that work is performed safely, and the pilot ergonomics program provides a preventive approach to ergonomic hazards among F&O mechanics. However, a weakness was identified related to WCD change control.

3.2 Work Planning and Control Implementation

This portion of the assessment evaluated SLAC's implementation of the WP&C institutional programs through the ISM core functions of defining the scope of work, identifying and analyzing hazards, developing and implementing hazard controls, and performing work within controls (feedback and continuous improvement is addressed in section 3.4 of this report).

Defining the Scope of Work

Reviewed work scopes for maintenance tasks conducted by F&O workers and technicians from the various laboratory directorates, as well as subcontracted construction activities, were sufficiently defined to permit identification of applicable hazards. The reviewed JSA associated with the B040A laser laboratory project adequately described the work scope for installing a new chiller. The contract statement of work for each of the four major construction contracts (CUIR, Large Scale Collaboration Center, Low Emittance Injector Tunnel [LEIT], and Building 57 modifications) coupled with associated JSAs adequately described the work scope to support hazard identification. Observed construction work activities were also well described in daily work release forms entitled *Construction Tailgate/Release Form* (ESH Manual, chapter 2).

Identifying and Analyzing Hazards

Reviewed WCDs and associated work observations demonstrated that hazards associated with most work activities were properly identified through SLAC and subcontractor JSAs, AHAs, and permits/forms. For example:

- Subcontractor hazard analysis for observed construction work was appropriately documented on the JSA form in accordance with the *Construction Work Planning and Control Procedure* (ESH Manual, chapter 2). JSAs for subcontractors performing construction work in support of the CUIR and Large Scale Collaboration Center projects and Building 57 lift station modifications provided generally adequate descriptions of work steps and associated hazards, with some exceptions (see the Deficiency D-SLAC-2 discussion below).
- The AHA associated with Radioactive Materials Storage Yard (RAMSY) Area Building 009A, which is used to store, process, package, and ship radioactive and mixed waste, adequately provided the scope of work, associated hazards, and controls for the activities performed in this area. Observation of work in the RAMSY Area was limited to activities in Building 009A. RAMSY was properly posted as a Radiologically Controlled Area and Radioactive Material Area.
- An observed work activity performed by F&O utility mechanics at area HX2 involving the cleaning of cooling tower screens was appropriately covered under the JSA and AHA. The reviewed JSA appropriately demonstrated that workers were involved in its development.

While hazards associated with most observed work activities were properly identified, contrary to DEAR 970.5223-1(b) and (c), approved WCDs (activity and training authorizations [ATAs], AHAs, and JSAs) for F&O, laboratory directorates, and construction subcontractor work activities did not properly identify, analyze, and document all work-related hazards (and associated controls). (See **Deficiency D-SLAC-2**.) Not properly identifying, analyzing, and documenting all potential hazards could result in work being performed without adequate safety controls in place. For example:

- The ATA form for Building 081 workers, which authorizes activities to be conducted in the building and identifies the respective hazards, controls, and training requirements, exhibited the following weaknesses, despite having been signed by the respective supervisor: (1) the form did not list battery charging as an activity and did not identify basic hazards and controls specific to a lead-acid battery charging area, (2) there was no evidence of a hazard assessment evaluating whether ventilation for this activity is adequate to protect workers from the buildup of explosive gases, (3) while the repair of vehicles and equipment (e.g., cars, trucks, forklifts, boom lifts, and scissor lifts) was appropriately listed as a work activity, the hazards section was incomplete and did not identify mechanical hazards associated with unexpected startup or energization of vehicles or components, and associated controls (e.g., required lockout/tagout [LOTO] and training).
- The ATA form for Building 35/462 workers, though approved by the respective Facilities Architecture supervisor, did not identify the fire and explosion hazards and controls associated with the paint spray booth.
- The JSA for the observed waveguide and solid-state amplifiers rack installation at Linac Sector 8 through Sector 10 did not include hazards and requisite controls associated with the use of elevated platforms and ladders, which are necessary for waveguide assembly. This condition was underscored by the observation of a platform ladder available for worker use in Sector 9-2 that lacked legible manufacturer rating information (the labels were washed out in color). Additionally, other subcontractor JSAs, such as for a McDonnell Roofing, Inc. task to apply weather weld on the edge of a roof, were completed by hand, and included some illegible text.
- The ATA for a worker and the AHA for the Building 25 Plating Shop did not specifically include hazards and controls for lead surface contamination due to peeling lead-containing paint present throughout the shop. There are postings in the area that alert occupants to lead-containing paint. Area management has not fully implemented any of three lead surface contamination control options recommended in a February 29, 2016, memorandum issued by the SLAC Office of Industrial Hygiene. Further, no JSA has been developed for employees to perform lead control housekeeping in this area, as was recommended in the memorandum. No surface sampling for lead has been performed at this location to determine the level of contamination from the peeling paint, nor is there a formal lead control housekeeping procedure for the shop. (See **OFI-SLAC-3**.)
- Direct radiation exposure hazards (and associated controls) were not properly identified and documented in four construction subcontractors' (DW Nicholson, PARC Environmental, Sprig Electric, McDonnell Roofing, Inc.) JSAs for CUIR work conducted in and around posted radiation areas. Despite the JSA weaknesses in radiological hazard and control identification, the direct radiation hazards and the corresponding controls were identified and documented in the CUIR-specific RWPs, which the construction contractors used while performing CUIR activities.

Developing and Implementing Hazard Controls

WCDs for many observed work evolutions included appropriate controls for the identified hazards and were properly implemented. For example:

- LOTO procedures implemented by electricians supporting subcontractor modifications at Building 57 incorporated effective safety practices, including a thorough review of potential shock and arc flash hazards. Supervisors and electrical workers prepared an appropriate group lockout energy isolation plan, effectively established electrical hazard boundaries, and verified test dates for voltage-rated PPE and voltage meter calibrations. The actual work involved electricians performing LOTO with category 2 arc-rated PPE, conducting zero energy verifications, and establishing group lockout. The LOTO was witnessed and the subcontractor (qualified electrical workers) added their own additional locks, ensuring a high level of collaborative safety.
- Observed work associated with Linac Coherent Light Source (LCLS) (Building 950) room 100H revealed robust laser safety controls. These controls were comprehensive, encompassing an appropriate set of engineering controls, administrative controls, and PPE. Engineering controls included interlocks, enclosures, shutters, and curtains. Administrative controls included designating laser safety and operations individuals and requiring workers to complete task-specific reading, on-the-job training, and a mandatory sweep of the area. PPE included laser safety eyewear based on the laser output.
- Three observed radiological work evolutions[2] were appropriately governed by RWPs. These RWPs clearly defined the scope of work and incorporated appropriate radiological controls. An example of these controls included supplemental dosimeters used to track and limit individual radiation doses for both CUIR subcontractor personnel and the calibration laboratory technician. Additionally, the RWPs ensured proper radiological job coverage and contamination controls during the jaw collimator work.
- Based on subcontractor's monitoring results for crystalline silica associated with observed tunnel boring activities at the LEIT, workers were assigned appropriate respiratory protection. Records showed that the workers were properly fit tested, enrolled in medical surveillance, and completed appropriate training.

While many observed work evolutions included appropriately developed and implemented controls, the following weaknesses were identified:

- Contrary to Cal/OSHA, Title 8, section 3314, *The Control of Hazardous Energy*, SLAC used administrative controls (locks and blue tags) for ten B905 cryoplant gaseous helium storage tank valves instead of required LOTO locks (with red tags) for the control of cryogenic, thermal energy, rapid expansion, and asphyxiation hazards. (See **Deficiency D-SLAC-3**.) Use of administrative controls does not provide the requisite controls specified by Cal/OSHA. The observed blue tags also did not have the same level of detail as required by HRS.00.00-OM-SLAC-LINAC, *Warm up Isolation*. Additionally, two other compliance issues were identified with a SLAC memorandum, Accelerator Directorate Cryogenics Division, dated January 8, 2026, and accompanying procedure:
    - Observed blue tags exhibited "DO NOT ENERGIZE," which does not match the SLAC memorandum specifying "DO NOT REMOVE THIS TAG" and "DO NOT OPERATE VALVE."
    - Observed blue tags did not uniquely identify the valve numbers as specified in procedure HRS.00.00-OM-SLAC-LINAC, section 3.
- Contrary to *Equipment Requirements*, section 2.2 (ESH Manual, chapter 41, *Hoisting and Rigging*), SLAC workers operated the mobile crane outside of the annual inspection period, used a four-leg

[2] Radiological work evolutions included: (1) CUIR cable tray installation work performed overhead in Klystron galleries and on the roof of the Linac by construction subcontractors, (2) machining of an activated jaw collimator support arm from the Linac, and (3) acceptance testing of vendor-calibrated supplemental dosimeters performed in the Building 24 Instrument Calibration Laboratory using a radiation source.

sling with an illegible inspection label, and did not use taglines to guide the load as required by the ordinary lift plan. (See **Deficiency D-SLAC-4**.) Not implementing defined controls could result in increased risk of accidents or injuries. Specifically, workers were observed using a mobile crane outside Building 2 Klystron Gallery sector 30-4, raising and lowering a platform/cage to move equipment and materials in and out of the hatch. The crane inspection was out of date (expired February 20, 2026); the four-leg sling (used to lift the hatch cover and basket) inspection tag was damaged and illegible; and workers did not use taglines to guide the load, instead using their hands, in violation of the associated Ordinary Lift Planning and Control Form, *Equipment hatches – installing or removing beamline equipment for customers*.

- Contrary to National Fire Protection Association (NFPA) 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, sections 5.6.1.1 and 5.6.1.2, SLAC's *Fire Prevention Hot Work Procedures* (ESH Manual, chapter 12, *Fire and Life Safety*) and SLAC-I-730-0A23L-003, *Construction Safety Requirements Manual*, do not establish compliant fire watch times. (See **Deficiency D-SLAC-5**.) Discrepancies in fire watch requirements could result in the selection of a fire watch performance time that is less conservative or ineffective in preventing secondary combustion. NFPA 51B establishes a minimum 60-minute fire watch requirement. The practice at SLAC for determining fire watch requirements allows for a methodology that could result in watch periods less than the minimum specified in NFPA 51B.

- Contrary to *Hazard Communication Requirements*, section 4 (ESH Manual, chapter 53, *Chemical Safety*), reviewed safety data sheets (SDSs) for three of four hazardous chemicals used in the Building 25 Plating Shop were not readily available or were outdated. (See **Deficiency D-SLAC-6**.) SDSs that are not readily available or are outdated could reduce hazard awareness or impede a prompt and proper first aid response if accidental exposure (splash) occurs. Specifically, the SDS for a corrosive material (METEX T 103) that is used in large quantities for parts cleaning was not included in the shop's SDS binders or available via the online SDS system. Also, two of the three other reviewed SDSs (contained in binders) for hazardous chemicals in use were outdated.

- Contrary to *Emergency Eyewash/Shower Requirements*, sections 3 and 4 (ESH Manual, chapter 53), inspection tags for an observed emergency shower and eyewash unit did not contain the required completed inspections. (See **Deficiency D-SLAC-7**.) A lack of documented inspections could impact equipment availability for emergency use by workers. Specifically, in the Building 25 Plating Shop, where workers face potential exposure to corrosive liquids, the inspection tag for the emergency shower showed no record of required monthly inspections/flushing for over four months. Also, inspection tags on the emergency eyewash unit were illegible and did not document the required weekly inspections/flushing.

- Contrary to *Posting Requirements*, section 2 (ESH Manual, chapter 6, *Confined Space*), one of two doors leading to the Building 052 supply fan room was not properly posted as a permit required confined space (PRCS), and neither door was posted with legible "danger – automatic start equipment" signs in accordance with Cal/OSHA subchapter 7, group 2, article 7, section 3320, *Warning Signs*. (See **Deficiency D-SLAC-8**.) The inadequate posting of hazardous areas could result in unauthorized access to PRCS fan rooms, posing risk of serious injury to workers. Specifically, during the work observation at Building 052, the observed supply fan room's two access doors were posted with signs that were faded and illegible. This room contains fans driven by electric motors that are controlled by fully automatic starters, requiring workers to remain alert when working near such machinery.

Performing Work Within Controls

Readiness to perform work was appropriately accomplished during observed PJBs. Observed tailgate meetings were effective in conveying readiness to perform work and included an overview of the specific work to be performed and a discussion of hazards and controls. Additionally, appropriate permits were assigned for the work, and stop-work authority was discussed and emphasized at most PJBs.

In most cases, observed work was performed in accordance with required controls specified in JSAs, AHAs, and RWPs. For example:

- Health physics technicians performed required routine radiation dose rate and contamination surveys in a variety of accelerator areas consistent with controls specified in the JSA entitled *Perform Radiation Protection Field Operations Survey Support in Accelerator Housings* and FO-001, *Routine Health Physics Technician Tasks in RPFO*. Appropriate survey instruments were used and were within the required calibration intervals. The resulting documented survey reports were legible, complete, and often accompanied by helpful sketches or photos.
- The JSA for observed HVAC work at Building 50 (IT services building) successfully identified LOTO placement for the control of hazardous energy associated with the repair of two unguarded hot water pump shafts. Electricians enhanced safety by using a remote actuator to open and close motor control center breakers, allowing the electricians to conduct work from outside the shock and arc flash boundaries. The use of this device provided an added layer of hazard control beyond the standard use of PPE routinely used to protect workers.
- The observed machining of the activated jaw collimator support arm at the Building 25 Machine Shop included appropriate establishment of a radiological contamination area boundary (to identify the work area and prevent unauthorized access) and an RWP. Milling operations were conducted in a manner that minimized secondary waste generation by using foil to confine generated metal chips and fines. The machinist wore PPE, including nitrile gloves, and appropriate radiological surveys were conducted during operation and after area cleanup to enable removal of the radiological postings for the contamination area.
- Observed work at the LCLS-II-HE LEIT construction project was performed in conformance with the approved ordinary lift planning and control forms, JSAs, excavation permits, and hot work permits.
- An observed PJB of HVAC and high voltage crews and the building manager (who authorized the work) was held prior to the performance of preventive maintenance on an air handler unit. Participants held discussions that were effective in enhancing situational awareness, agreeing on assigned tasks and discussing identified hazards and controls and protocols for pausing work. Additionally, observed confined space entry into the HVAC air handling unit penthouse at Building 052 was performed within the procedures. Electrical workers de-energized power at the breaker disconnects using appropriate arc flash PPE.

While most work evolutions were performed in accordance with required controls, the following weaknesses were identified:

- Contrary to the *Scaffold Erecting and Dismantling Procedure* (ESH Manual, chapter 15, *Ladder and Scaffold Safety*) and training course 164, *Safe Use of Scaffolds*, a scaffold tag inspection did not identify that the tag containing the approval information for the scaffold was faded to white, a nonstandard color. (See **Deficiency D-SLAC-9**.) Not ensuring that scaffold tags exhibit the appropriate color could preclude worker awareness of important limitations. The only authorized colors are red, yellow, and green to notify potential users of the use condition (unsafe, safe with limitations, and safe for use, respectively). Specifically, during observed routine inspections of the radiological posting of a scaffold at Linac Sector 28, the inspector did not address the condition of the tag, which was washed out in color and appeared to be white. Reviewed inspection records for the previous few days also did not identify the condition of the tag.

- Contrary to JSA LCLSII-HE-1.2-PP-0374, *Cryomodule Load/Unload, Unloading a Cryomodule without a mobile crane or subcontractors*, observed workers were positioned beneath a load while it was being supported over dollies by hydraulic jacks. (See **Deficiency D-SLAC-10**.) Workers who are positioned beneath loads could be subjected to crush or pinch-point hazards. The JSA, step 10, "Move Cryomodule on SLAC transport dollies (into or out of Adit) controls," identifies the control "Push sticks provided to prevent technician from reaching under suspended loads to adjust cribbing or wheels." This control was not implemented by the F&O technicians and workers while unloading the cryomodule.

Work Planning and Control Implementation Conclusions

Implementation of WP&C institutional programs, including the ISM core functions, for observed SLAC and construction subcontractor work was generally adequate. Workers and supervisors were observed to be directly involved in the implementation of the ISM process. In most cases, observed work was performed in accordance with required controls from JSAs, AHAs, ATAs, and RWPs, where appropriate. However, weaknesses were identified in the areas of hazard identification, developing and implementing controls, and work performance.

3.3 Flowdown of Safety Requirements to Subcontractors

This portion of the assessment evaluated SLAC's flowdown of DOE safety requirements, including DEAR 970.5223-1, *Integration of environment, safety and health into work planning and execution*, to its subcontractors performing construction work at SLAC facilities, the communication of safety requirements to subcontractors during pre-work meetings, and oversight of contracted construction work.

Safety and health requirements, including DEAR 970.5223-1, Cal/OSHA, and DOE, are adequately flowed down through SLAC's procurement and contractual process, the IIPP, the ESH Manual, and WP&C procedures to subcontractors performing construction activities. SLAC's procurement process for subcontractors rigorously integrates safety, guided by its WP&C framework and an IIPP that is compliant with Cal/OSHA under a 10 CFR 851 variance. This process appropriately involves subcontractor pre-qualification, Experience Modification Rate review, and contractual safety mandates. JSAs and daily tailgate forms, mandatory safety training, PJBs, and universal stop-work authority are appropriately required for work authorization and release. Additionally, a subcontractor safety qualification form is required prior to bid submittal, and SLAC appropriately acknowledges receipt of all documentation through the *SLAC Receipt of Subcontractor Form* (ESH Manual, chapter 2). Points of contact at SLAC for general subcontracts, and construction managers or service managers for larger projects, function as day-to-day technical representatives for subcontractors. These individuals are supported by safety, IH, quality assurance, and training professionals who communicate requirements and perform assessments to appropriately assess and document compliance, as detailed in ESH Manual, chapter 42, *Subcontractor Safety*.

The implementation of safety requirements for construction contractors and subcontractors is adequately managed through SLAC's WP&C framework. This framework mandates subcontractor compliance with the overarching *Construction Work Planning and Control Procedure* (ESH Manual, chapter 2), which outlines processes for hazard identification, control implementation, and work authorization. Subcontractors are appropriately required to develop and use the *Construction Job Safety Analysis Form* (ESH Manual, chapter 2) to identify hazards and controls. The form is appropriately signed by the subcontractor foreman acknowledging that hazards were identified, workers were trained, and controls are in place. Daily work authorization and communication of site-specific hazards occur using the *Construction Tailgate/Release Form* (ESH Manual, chapter 2), with the SLAC construction manager providing final daily release. Mandatory PJBs, guided by the *Construction Pre-job Briefing Checklist* (ESH Manual, chapter 2), are conducted at critical project junctures. All construction workers are required to complete ESH Course 375, *Construction Safety Orientation*, and supervisors are required to attend Facilities Course 101, *Subcontractor Safety Management Training*. Directorate ESH coordinators, construction managers, and safety coordinators (assigned by the Health and Safety Services Office, ESH division) are integrated into contractor/subcontracted construction projects, providing added assurance that work is being performed safely. This comprehensive system to manage contractors and subcontractors appropriately ensures that safety is planned, communicated, authorized, and continuously monitored, with all personnel retaining stop-work authority. Several reviewed subcontracts, including field documentation verification and observations of associated construction work, demonstrated that the flowdown of ESH requirements to subcontractors and their lower tiers was effectively accomplished.

Flowdown of Safety Requirements to Subcontractors Conclusions

SLAC's subcontractor procurement process appropriately flows down DOE safety requirements, including DEAR 970.5223-1. Several reviewed subcontracts, including field documentation verification and observations of associated construction work, demonstrated that the flowdown of ESH requirements to subcontractors and their lower tiers was effectively accomplished.

3.4 Contractor Assurance System/Feedback and Improvement

This portion of the assessment evaluated the adequacy of SLAC's CAS program documents/processes and effectiveness of implementation, including assessments, issues management, and performance feedback and lessons learned, to enable the continuous improvement of WP&C.

SU's CAS program, *Stanford University's Contractor Assurance System for the SLAC National Accelerator Laboratory* [SCAS] (no document number), approved by SSO on April 8, 2024, appropriately integrates with SLAC's CACM-2018-049, *Quality Assurance Program* [QAP]. SLAC voluntarily selected the International Organization for Standardization (ISO) 9001:2015, *Quality Management Systems*, as the consensus standard used to develop SLAC's working level processes of the QAP in alignment with *DOE Order 414.1E – Quality Assurance Program/Site Compliance Plan* [SCP] (dated 7/15/2025, no document number). The SCAS details a Board of Oversight and four committees (Operations; Projects and Infrastructure; Risk, Audit, and Compliance; and Science and Technology) overseeing SU's process management. Although SSO revised the SU contract language for greater flexibility, the SCAS still appropriately lists the original 10 specific requirements (promulgated by a January 2010 DOE Office of Science memorandum) as "objectives." The SCAS also appropriately includes a "Document Crosswalk to SLAC program documents and processes," which identifies "documents" for each of the 10 objectives.

SLAC's assessment program, CACM-2018-017, *Institutional Assessment Program* [IAP], appropriately addresses management and independent assessments, including defined roles and responsibilities, training, templates for plans and reports, and checklists for evaluating report quality. Additionally, the IAP describes an annual risk-based planning process for assessments. Reviewed integrated assessment schedules (IASs) demonstrated SLAC's commitment to increasing the proportion of self-assessments from 42% of total assessments in fiscal year 2025 to 61% in fiscal year 2026. The manager of SLAC's Division of Contractor Assurance explained that the current IAS database has fundamental limitations requiring a work-around system to enable use of data for analysis and reporting. Also, the interviewed Projects and Portfolio Office Manager provided examples of current project and readiness review procedures that demonstrate improved performance review mechanisms within the line organization.

SLAC has established and implemented an issues management program through CACM-2018-031, *Issues and Improvements Program*, and the SLAC Issues and Improvements Management System (SIIMS). The issues and improvements program appropriately identifies issue sources (assessments, incidents, and operational activities) and addresses issue tracking, corrective actions, and effectiveness reviews. Issues are appropriately graded as findings (with four significant levels), OFIs, or noteworthy practices. Reviewed assessment findings, 30 from four self-assessments and 4 from two independent assessments, were appropriately entered and tracked in SIIMS.

SLAC has established and implemented a generally adequate approach to feedback and improvement through the lessons learned program (LLP) and metrics. SLAC's *Work Integration Plans Form* (ESH Manual, chapter 2) appropriately provides a mechanism for verifying the conduct of post-job reviews. The SLAC Lessons Learned Coordinator is an active participant in the DOE Operating Experience (OPEX) committee and is an active promoter of DOE OPEXShare subscriptions to expand the reach of DOE complex lessons learned within the SLAC community. The LLP demonstrates a commitment to continuous improvement by establishing a review committee to disseminate appropriate lessons learned, recently requiring their incorporation into PJBs. This proactive approach supports organizational learning and accident prevention. SLAC collects a comprehensive set of performance measures, presented semiannually to the Laboratory Director. These metrics include analyses and identified actions for performance improvement, providing a foundation for data-driven decision-making.

Although a documented SCAS and implementation processes have been established, the following weaknesses were identified:

- The interviewed Chief Assurance Officer and manager of SLAC's Division of Contractor Assurance acknowledged that current CAS program documents are a blend of policy and procedure that lack clarity and asserted that they are working to improve these documents. (See **OFI-SLAC-4**.)
- SLAC has conducted self-assessments in several functional areas, but there have been limited WP&C programmatic self-assessments since 2022. (See **OFI-SLAC-5**.)
- SLAC does not use a single unified platform to track lower-level issues. Rather, each directorate uses its own mechanism, making it challenging to perform comprehensive analysis across all relevant worker safety and health issues and limiting the ability to identify broader trends. (See **OFI-SLAC-6**.)
- The QAP only requires causal analysis for issues related to abnormal events or conditions. Also, CACM-2018-031 only addresses causal analysis for issues derived from incident investigations. (See **OFI-SLAC-7**.)
- Front line managers (e.g., construction managers, area managers) do not actively use metrics to monitor functional performance and proactively identify performance issues. Four interviewed lower-level managers explained that they do not use any metrics. (See **OFI-SLAC-8**.)
- SLAC does not provide a mechanism for collecting post-job feedback from operational or construction activities. The *Work Planning and Control Procedure* (ESH Manual, chapter 2) addresses worker feedback expectations but provides no means for collection and documentation. (See **OFI-SLAC-9**.)

Contractor Assurance System/Feedback and Improvement Conclusions

SLAC has established and implemented a generally adequate CAS program, with assessments, issues management, and processes for performance feedback and lessons learned to enable continuous improvement. However, weaknesses were identified relating to policy and program documentation clarity, the frequency of WP&C programmatic self-assessments, the collection of lower-level issues, causal analysis, the use of metrics by front line managers, and post-job feedback.

4.0 BEST PRACTICES

No best practices were identified during this assessment.

5.0 FINDINGS

No findings were identified during this assessment

6.0 DEFICIENCIES

Deficiencies are inadequacies in the implementation of an applicable requirement or standard. Deficiencies that did not meet the criteria for findings are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

SLAC National Accelerator Laboratory

Deficiency D-SLAC-1: SLAC has not developed a required systematic change control process for modifying WCDs, such as JSAs, AHAs, forms, and permits. (DEAR 970.5223-1(e))

Deficiency D-SLAC-2: F&O workers, laboratory directorate technicians, and construction subcontractors did not properly identify, analyze, and document all work-related hazards (and associated controls) in WCDs (ATAs, AHAs, and JSAs). (DEAR 970.5223-1(b) and (c))

Deficiency D-SLAC-3: SLAC used administrative controls (locks and blue tags) for ten B905 cryoplant gaseous helium storage tank valves instead of required LOTO locks (with red tags) for the control of cryogenic, thermal energy, rapid expansion, and asphyxiation hazards. (Cal/OSHA, Title 8, sec. 3314)

Deficiency D-SLAC-4: SLAC workers operated the mobile crane outside of the annual inspection period, with an illegible inspection label for the four-leg sling, and without the use of taglines, contrary to the ordinary lift plan. (*Equipment Requirements*, sec. 2.2 [ESH Manual, ch. 41])

Deficiency D-SLAC-5: SLAC's *Fire Prevention Hot Work Procedures* (ESH Manual, chapter 12) and SLAC-I-730-0A23L-003, *Construction Safety Requirements Manual*, do not establish compliant fire watch times. (NFPA 51B, secs. 5.6.1.1 and 5.6.1.2)

Deficiency D-SLAC-6: SLAC SDSs for three of four reviewed hazardous chemicals used in the Building 25 Plating Shop were not readily available or were outdated. (*Hazard Communication Requirements*, sec. 4 [ESH Manual, ch. 53])

Deficiency D-SLAC-7: SLAC has not ensured that all inspection tags for eyewash stations contain the required completed inspections. (*Emergency Eyewash/Shower Requirements*, secs. 3 and 4 [ESH Manual, ch. 53])

Deficiency D-SLAC-8: SLAC has not ensured that both doors leading to the Building 052 supply fan room are properly posted as a PRCS and posted with legible "danger – automatic start equipment" signs. (*Posting Requirements*, sec. 2 [ESH Manual, ch. 6], and Cal/OSHA subch. 7, group 2, article 7, sec. 3320)

Deficiency D-SLAC-9: SLAC's scaffold tag inspections do not ensure that all tags containing approval information for scaffolds exhibit only authorized colors (i.e., red, yellow, and green). (*Scaffold Erecting and Dismantling Procedure* [ESH Manual, ch. 15] and training course 164)

Deficiency D-SLAC-10: SLAC workers were observed positioned beneath a load while it was being supported over dollies by hydraulic jacks. (JSA LCLSII-HE-1.2-PP-0374)

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified the OFIs shown below to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in assessment reports, they may also address other conditions observed during the assessment process. These OFIs are offered only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory. Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

SLAC National Accelerator Laboratory

OFI-SLAC-1: Consider developing an exposure assessment model that follows the American Industrial Hygiene Association's *A Strategy for Assessing and Managing Occupational Exposures*.

OFI-SLAC-2: Consider augmenting IH staff to ensure the effective management of existing IH programs, proper maintenance of IH equipment, timely fulfillment of sampling requests, and the development and maintenance of a robust exposure assessment program.

OFI-SLAC-3: Consider developing a formal lead control housekeeping procedure and performing surface sampling for lead to determine the hazard posed by surface contamination and to help prioritize housekeeping activities.

OFI-SLAC-4: Consider updating the SCAS, the SCP, and the QAP to improve clarification of policy and program documentation based on defined requirements.

OFI-SLAC-5: Consider increasing the frequency of scheduled WP&C programmatic assessments in the IAS.

OFI-SLAC-6: Consider updating program documentation to specify requirements related to submittal of issues at all levels into a single platform for tracking.

OFI-SLAC-7: Consider including a graded approach to performing causal analysis (e.g., root cause, apparent cause) for all issues (not just those related to abnormal events or conditions) to assure management that the proper causes are identified or that corrective actions are properly focused to resolve significant issues and prevent recurrence.

OFI-SLAC-8: Consider training and encouraging front line managers to leverage available metrics to gain potential insights that would facilitate the proactive identification of performance issues and data-driven decision-making and improve functional performance.

OFI-SLAC-9: Consider establishing a means for workers to document post-job feedback.

Appendix A
Supplemental Information

Dates of Assessment

February 5 to April 1, 2026

Office of Enterprise Assessments (EA) Management

Mark D. Barth, Acting Director, Office of Enterprise Assessments
Eric A. Ruesch, Acting Director, Office of Environment, Safety and Health Assessments
Tamara D. Powell, Director, Office of Nuclear Safety and Environmental Assessments
David Olah, Director, Office of Worker Safety and Health Assessments
Wade W. Gough, Acting Director, Office of Emergency Management Assessments
Brent L. Jones, Director, Office of Nuclear Engineering and Safety Basis Assessments

Quality Review Board

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