



Department of Energy

Washington, DC 20585

September 3, 2009

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Dr. Persis Drell
Director
SLAC National Accelerator Laboratory
2575 Sand Hill Road
Menlo Park, California 94025

WEA 2009-01 (FNOV)

Dear Dr. Drell:

Pursuant to section 234C of the Atomic Energy Act, as amended, 42 U.S.C. § 2282c, and the Department of Energy's (DOE) regulations at 10 C.F.R. Part 851, *Worker Safety and Health Program*, DOE is issuing this Final Notice of Violation (FNOV) to Stanford University. The FNOV finds Stanford University liable for violations of DOE's worker safety and health requirements. The FNOV is based upon the Office of Enforcement's July 23, 2008, Investigation Report and a careful and thorough review of all evidence presented to DOE by Stanford University, including your original investigation, corrective actions, and response to the Preliminary Notice of Violation (PNOV). For reasons set forth in enclosed FNOV, DOE finds no basis for modification of the PNOV.

Pursuant to 10 C.F.R. § 851.44(a), Stanford University may petition DOE's Office of Hearings and Appeals for review of the enclosed FNOV. Stanford University's petition must adhere to the procedural requirements established in Subpart G of 10 C.F.R. Part 1003, *Office of Hearings and Appeals Procedural Regulations*. If Stanford University does not petition the Office of Hearings and Appeals for review within 30 calendar days of receipt of this FNOV, Stanford University relinquishes any right to appeal any matter, and the FNOV will become a final order as provided by 10 C.F.R. § 851.43(c).

Sincerely,

A handwritten signature in black ink, appearing to read "John S. Boulden III".

John S. Boulden III
Acting Director
Office of Enforcement
Office of Health, Safety and Security

Enclosure



cc: William Brinkman, SC-1
Paul Golan, SSO
Brian Sherin, SLAC
Rachel Claus, SLAC
Richard Azzaro, DNFSB

Enclosure

Final Notice of Violation

Stanford University
SLAC National Accelerator Laboratory

WEA-2009-01

The Department of Energy (DOE) conducted an investigation into the facts and circumstances surrounding the September 13, 2007, polyvinyl chloride (PVC) pipe explosion that occurred in Sector 30 of the linear accelerator facility at the SLAC National Accelerator Laboratory (SLAC). The investigation identified multiple violations of DOE worker safety and health requirements by Stanford University.

On April 3, 2009, DOE issued a Preliminary Notice of Violation (PNOV) to Stanford University for three Severity Level I violations of 10 C.F.R. Part 851, *Worker Safety and Health Program*. Although authorized to impose a civil penalty under 10 C.F.R. § 851.5(a), DOE elected to forego the proposed penalty of \$210,000 because Stanford University is a not-for-profit contractor that does not receive a fee under its DOE contract.

DOE received Stanford University's reply to the PNOV on April 30, 2009. Stanford University did not raise substantive objections to the alleged violations, agreeing that the September 2007 explosion was a very serious event for which the University's management team should take full responsibility. Stanford University asked DOE to reconsider its decision to not grant any mitigation of the proposed civil penalty claiming that DOE did not give due consideration to Stanford University's and SLAC's management actions "to address gaps in the management and safety culture." Stanford University also requested that DOE reconsider the decision to impose civil penalties on the two subcontractors involved in the event, Western Allied Mechanical, Inc. (Western Allied) and Pacific Underground Construction, Inc. (Pacific Underground). The reply to the PNOV stated that DOE's proposal of penalties against the two subcontractors was an unprecedented action that undermined "15 years of precedent." Additionally, unless reconsidered, DOE's actions may (1) reduce the pool of qualified contractors willing to work at DOE sites; (2) unnecessarily increase costs; and (3) undermine historic DOE contractual relationships to the extent that subcontractors might regard DOE on-site personnel as overseers with the power to impose penalties.

DOE has thoroughly evaluated the reply and finds that none of the arguments raised by Stanford University justify the reconsideration requested. With regard to Stanford University's civil penalty mitigation request, DOE considered the management actions cited in the reply when developing the PNOV. However, these actions were determined to constitute an insufficient basis for mitigation when weighed against other civil penalty adjustment factors. These factors

include the repetitive nature, extent, and consequences of the work planning and control deficiencies identified by DOE yet uncorrected before this event; the limited scope of the investigative efforts following this event; and evidence of ineffective corrective actions implemented in response to this event. Based upon careful consideration of these circumstances, DOE's decision against mitigation is justified.

DOE disputes the assertion that its assessment of fines against two SLAC subcontractors is unprecedented. Since the inception of the enforcement program, DOE has been required to investigate and decide whether to initiate enforcement action against contractors, subcontractors, and suppliers. In 1996, for example, both a contractor and its subcontractor received PNOVs proposing civil penalties for violations of DOE's nuclear safety requirements; more recently, in 2003, DOE directly assessed civil penalties against a subcontractor and its supplier for violations of DOE's nuclear safety requirements. Since February 9, 2007, DOE has been charged with the additional responsibility of considering enforcement actions against contractors, subcontractors, and suppliers that violate the Department's worker safety and health requirements. DOE has a Congressional mandate to investigate, identify noncompliances and, if the facts require, assess penalties on contractors and subcontractors at any tier in order to deter or prevent workplace injuries, illnesses, and accidental losses. To exclude subcontractors that violate DOE worker safety and health requirements from penalties would contravene section 234C of the Atomic Energy Act.

Finally, as to Stanford University's concern that DOE's enforcement actions against subcontractors will increase costs, reduce the pool of available subcontractors, and impair site relationships, DOE must balance these considerations against the obligation of subcontractors under Part 851 to provide a place of employment free from recognized hazards that could cause death or serious physical harm to workers. In considering these factors, DOE finds no basis to hold one group of contractors working at a DOE site to a lesser standard of worker safety and health protection than others.

For the foregoing reasons, DOE believes that the enforcement action against Stanford University should remain unchanged, with the expectation that it will prevent a recurrence with even more serious consequences. Pursuant to 10 C.F.R. § 851.43(b), DOE now issues this Final Notice of Violation (FNOV) to Stanford University for three Severity Level I violations of DOE's worker safety and health regulations as set forth below.

Final Violations

I. Construction Safety

Title 10 C.F.R. § 851.24, *Functional areas*, requires that “[c]ontractors must have a structured approach to their worker safety and health program which at a minimum, include provisions for ... construction safety” and that “[c]ontractors must comply with the applicable standards and provisions in Appendix A of this part, entitled ‘Worker Safety and Health Functional Areas’.”

Appendix A, Section 1, *Construction Safety*, states that “[f]or each separately definable construction activity (e.g., excavations, foundations, structural steel, roofing), the construction

contractor must: [p]repare and have approved by the construction manager an activity hazard analysis prior to commencement of affected work. Such analyses must: [i]dentify foreseeable hazards and planned protective measures....” and “[e]nsure workers are aware of foreseeable hazards and the protective measures described within the activity analysis prior to beginning work on the affected activity.”

Appendix A, section 1(d) states that “[t]he construction contractor must prepare a written construction project safety and health plan to implement the requirements of this section and obtain approval of the plan by the construction manager prior to commencement of any work covered by the plan. In the plan, the contractor must designate the individual(s) responsible for on-site implementation of the plan, specify qualifications for those individuals, and provide a list of those project activities for which subsequent hazard analyses are to be performed.”

Contrary to these requirements, Stanford University failed to ensure that Western Allied developed a construction project safety and health plan and activity hazard analysis to effectively implement the requirements of appendix A, section 1. The site-specific safety plan (SSSP) and job safety analysis (JSA) prepared by Western Allied did not adequately identify and assess the hazards associated with the piping replacement work being conducted in Sector 30 of the linear accelerator facility or establish controls necessary to eliminate or abate those hazards to protect workers. Specific examples are listed below:

- A. The “Sub Contractor Site Specific Health & Safety Plan Form” for the “SLAC Underground Utilities Upgrade” project that was prepared and submitted by Western Allied and approved by the SLAC project manager did not identify any project activities for which subsequent hazard analyses would be performed. The form contained only generic information about the scope of work to be performed and the associated hazards and hazard controls to be implemented by Western Allied. The form also did not specify the qualifications of the competent person designated on the form by Western Allied as responsible for oversight of specific and daily operations conducted under the plan.
- B. The JSA prepared by Western Allied for the piping replacement work, “CTW Piping Replacement – Sectors 21 thru 30,” dated September 4, 2007, did not identify foreseeable hazards and appropriate protective measures for the work to be performed.
 1. Stanford University representatives, including the project manager and university technical representative (UTR), periodically signed the JSA as part of daily sign-in expectations, but Stanford University, as construction manager, did not formally approve the JSA.
 2. The JSA identified “solvents & cements” as potential hazards and “PVC solvent/cement” as a hazardous material that would be used at the job site. The JSA failed to identify the following properties and precautions for use of those materials as identified on (1) the material safety data sheet (MSDS) for IPS Weld-On solvent cement for PVC plastic pipe, dated April 2007; (2) the MSDS for IPS Weld-On adhesive primer for plastic, dated June 2007; and (3) the IPS Weld-On PVC 2711 plastic pipe cement product label:

- A flammability rating of 3
 - Keep away from heat, sparks, open flame, and other sources of ignition
 - Vapors may ignite explosively
 - Use with adequate ventilation.
3. The JSA listed “cutting and torching of bolts” as a phase of work/job step and “static electricity and sparks” as potential hazards. The analysis failed to consider the potentially explosive conditions created by the combination of ignitable vapors from the PVC primer and cement, an enclosed space (i.e., sealed piping system), and the application of heat to the carbon steel piping attached to the PVC piping. The work documents and SSSP for the project did not identify the need to install a pressure gauge in the piping system so that required pressure testing could be performed. The JSA did not identify the task of cutting into and welding on the newly installed carbon steel piping to install a pressure gauge.

Collectively, these deficiencies constitute a Severity Level I violation. As explained in 10 C.F.R. Part 851, Appendix B, Section VI(b)(1), *Severity of Violations*, “[a] Severity Level I violation is a serious violation. A serious violation shall be deemed to exist in a place of employment if there is a potential that death or serious physical harm could result from a condition which exists, or from one or more practices, means, methods, operations, or processes which have been adopted or are in use, in such place of employment.”

II. Fire Protection

Title 10 C.F.R. § 851.23, *Safety and health standards*, requires compliance with 29 C.F.R. Part 1926, *Safety and Health Regulations for Construction*. Section 1926.352(i) states that “[d]rums, containers, or hollow structures which have contained toxic or flammable substances shall, before welding, cutting, or heating is undertaken on them, either be filled with water or thoroughly cleaned of such substances and ventilated and tested.”

Title 10 C.F.R. § 851.24, *Functional areas*, requires that “[c]ontractors must have a structured approach to their worker safety and health program which at a minimum, include provisions for ... fire protection” and that “[c]ontractors must comply with the applicable standards and provisions in Appendix A of this part, entitled ‘Worker Safety and Health Functional Areas’.” Appendix A, Section 2, *Fire Protection*, states that “[c]ontractors must implement a comprehensive fire safety and emergency response program to protect workers commensurate with the nature of the work that is performed,” and that “[a]n acceptable fire protection program...includes meeting applicable building codes and National Fire Protection Association [NFPA] codes and standards.”

National Fire Protection Association (NFPA) 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2003 edition, establishes the following provisions:

- Section 3.3.5 defines the permit authorizing individual (PAI) as “[t]he individual designated by management to authorize hot work.”

- Section 4.1 states that “[m]anagement or a designated agent shall be responsible for the safe operations of hot work activity.”
- Section 4.1.2 states that “[m]anagement shall designate a [PAI].”
- Section 4.1.6 states that “[m]anagement shall ensure that all individuals involved in the hot work operations, including contractors, are familiar with the provisions of [NFPA 51B].”
- Section 4.1.6.2 states that “[i]ndividuals involved in hot work operations shall have an awareness of the inherent risks involved....”
- Section 4.1.7 states that “[m]anagement shall advise all contractors about site-specific flammable materials, hazardous processes or conditions, or other potential fire hazards.”
- Section 4.2.1 states that “[t]he PAI shall determine site-specific flammable materials, hazardous processes, or other potential fire hazards that are present or likely to be present in the work location.”
- Section 5.1.1 states that “[h]ot work shall be permitted only in areas that are or have been made fire safe.”
- Section 5.2(4) states that “[h]ot work shall not be permitted...[i]n the presence of uncleaned or improperly prepared drums, tanks, or other containers and equipment that have previously contained materials that could develop explosive atmospheres.”
- Section 5.3.1 states that “[b]efore hot work operations begin in a nondesignated location, a written hot work permit by the [PAI] shall be required.”
- Section 5.3.4 states that “[t]he area shall be inspected by the PAI at least once per day while the hot work permit is in effect to ensure that it is a fire-safe area.”

Section 1.1.2 of NFPA 51B requires compliance with American National Standards Institute (ANSI) Z49.1, *Safety in Welding, Cutting, and Allied Processes*. ANSI Z49.1, 2005 edition, establishes the following provisions:

- Section 3.2.1.2 states that “[m]anagement shall assure that hazards and safety precautions are communicated to workers and understood by workers prior to the start of work.” The explanatory information for section 3.2.1.2 states that “hazards which may be involved in welding are communicated to users through manufacturers instructions, material safety data sheets, and product labeling.”
- Section 3.2.1.3 states that “[m]anagement shall designate approved areas, and establish procedures for safe welding and cutting.” This section also states that “[a] designated management representative shall be responsible for authorizing welding and cutting operations in areas not specifically designated or approved for such processes” and that

“[m]anagement shall assure that the individual is aware of the hazards involved and familiar with the provisions of [ANSI Z49.1].”

- Section 3.2.1.5 states that “[m]anagement shall select contractors to perform welding who...have an awareness of the risks involved.” and that “[m]anagement shall advise contractors about flammable materials or hazardous conditions that are specific to the job site.”
- Section 3.2.3.1 states that “[w]elders shall understand the hazards of the operation to be performed and the procedures being used to control hazardous conditions.”
- Section 3.2.3.3 states that “[w]elders shall cut or weld only where all safety precautions have been met.”
- Section 6.3 states that “[b]efore welding or cutting is begun in a location not designed for such purposes, inspection and authorization by a designated management representative shall be required.”
- Section 6.4 states that “[w]elding or cutting work shall not be started until the container has been prepared for hot work.”

Contrary to these requirements, Stanford University failed to implement proper hot work procedures and fire prevention measures, and failed to ensure that Western Allied implemented welding and cutting fire safety control measures. Furthermore, Stanford University failed to ensure that Pacific Underground and Western Allied adequately trained their employees on the safety standards and requirements applicable to welding under 10 C.F.R. Part 851 and on potential hazards associated with the piping replacement project. Specific examples are listed below:

- A. Stanford University did not designate a PAI to authorize hot work. During the Office of Enforcement’s investigation, however, the SLAC fire marshal indicated that he fulfilled the functions of the PAI for hot work performed at SLAC.
- B. Permit # 00-2396, dated September 6, 2007, which was issued for the utilities upgrade hot work to be performed by Western Allied, was not signed or otherwise approved by the PAI (i.e., SLAC fire marshal).
- C. Stanford University did not identify flammable hazards associated with the utilities upgrade work performed by Western Allied as part of the hot work permit process. Permit # 00-2396 identified burning, brazing, cutting, grinding, soldering and welding as the work to be completed by the subcontractor, and identified the location as “LINAC Sec 21 – 30 Mech Alcove.” The permit did not provide any information specific to the locations where the hot work would be performed or any equipment, materials, or processes that might be involved in or affected by the hot work activities. The PAI did not evaluate the hot work activity prior to the commencement of operations by Western Allied to determine the extent of the welding process, the condition of the worksite, the potential for flammable and explosive hazards

introduced by the PVC primer and cement, or special precautions or mitigations to be followed, such as purging and monitoring for vapor buildup.

- D. The PAI did not inspect the Sector 30 mechanical alcove work area before Western Allied was provided a hot work permit or before hot work was conducted. The PAI did not visit the hot work area on a daily basis after permit issuance to ensure that hot work performed by Western Allied complied with the provisions of NFPA 51B. The permit issuance process failed to effectively evaluate and identify hazards associated with Western Allied's hot work.
- E. Stanford University, as construction manager, failed to ensure worker protection from flammable and explosion hazards through the adoption of work control measures such as purging or cleaning the pipes and monitoring for vapor buildup to verify the absence of a potentially explosive atmosphere.
- F. Stanford University did not establish effective procedures to ensure that welding and cutting would be performed safely. Chapter 12, *Fire and Life Safety* (dated May 21, 2007) of the SLAC Environment, Safety, and Health Manual requires that a fire prevention hot work permit be obtained from the fire department before performing hot work, but does not identify any other requirements pertaining to the planning, control, or conduct of hot work. An exhibit related to chapter 12 establishes "Fire and Life Safety: Fire Prevention Hot Work Guidelines" including a guideline that states "do not perform hot work in areas where flammable liquids, or vapors, lint, dust or combustible storage is at risk of ignition" and other important controls for ensuring the safe performance of hot work. There is no requirement for SLAC personnel or subcontractors to follow these guidelines or to incorporate these controls into the hot work permit.
- G. Stanford University did not ensure that Pacific Underground and Western Allied employees were trained in and familiar with the provisions of NFPA 51B and ANSI Z49.1. Pacific Underground and Western Allied employees interviewed during the Office of Enforcement's investigation were unfamiliar with these standards and the requirements contained therein. Stanford University also failed to ensure that Western Allied employees were informed of the hazards and protective measures associated with performing hot work on piping that could contain ignitable vapors. Western Allied employees have performed pipefitting work with carbon steel at SLAC previously; however, the welder performing the hot work on September 13, 2007, had no experience working with a piping configuration comprised of different materials (ductile iron, PVC, and steel) such as the one used in the underground utilities upgrade in Sector 30. The welder did not consider the potential flammable and explosion hazards associated with usage of PVC primer and cement in a closed pipe system based on a review of applicable MSDSs and product labels before welding.

Collectively, these deficiencies constitute a Severity Level I violation.

III. General Requirements

Title 10 C.F.R. § 851.10, *General requirements*, states that "the contractor must: [e]nsure that work is performed in accordance with: (i) [a]ll applicable requirements of [Part 851]; and (ii)

[w]ith [sic] the worker safety and health program for that workplace.” The *SLAC Worker Safety and Health Program Description* (SLAC-I-720-0A21B-001-R000), dated February 2007, incorporates by reference the latest version of Chapter 42, *Subcontractor Construction Safety*, of the *SLAC Environment, Safety, and Health Manual*. The following refers to requirements in chapter 42 dated June 1, 2007.

- Section 5.1.2.4 states that “[s]ubcontractors are required to submit a site-specific safety plan (SSSP)” and that “[t]he SSSP must describe the work to be performed, outline the hazards anticipated to be encountered with each task, and the specific mitigation.” The SSSP must also “[d]escribe the system used to ensure personnel will comply with safe and healthy work practices, including [s]afety indoctrination and safety meetings, [w]orker training in hazard recognition, [d]isciplinary policy, and [d]escribe the system used to communicate with personnel, including notification of hazards.” This section also states “SSSPs are approved by the [project manager].”
- Section 5.1.2.5 states that “JSAs must be prepared and reviewed at the start of any on-site work and any new phase or task and will be reviewed daily.” This section also states that “UTRs must also review the JSAs.”
- Section 5.1.3.3 requires that “SLAC [project managers] and/or UTRs, the construction safety program manager, and subcontractors must perform daily inspections of activities and work sites relevant to the work being performed that day to ensure that the subcontractor is working within identified controls and has effectively controlled identified hazards.” This section further states that “[a]ll inspections, findings, and corrective measures must be documented and be available for review” and that “daily inspection records must be kept at the job site.”

Contrary to these requirements, Stanford University failed to perform work in accordance with SLAC’s approved Worker Safety and Health Program and associated implementing procedures. Specific examples include the following:

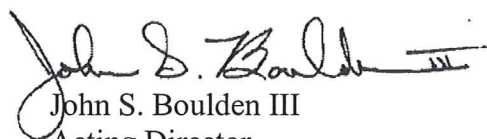
- A. Stanford University did not document the results of safety inspections of the work performed by Pacific Underground or Western Allied in Sector 30 of the linear accelerator facility.
- B. Stanford University failed to ensure that the safety plans submitted by Western Allied complied with SLAC’s project planning requirements. The SSSP submitted by Western Allied and approved by the SLAC project manager did not address the required elements of chapter 42, section 5.1.2.4 described above. The SSSP did not address the task of fabricating new piping using mixed materials, usage of PVC adhesive primer and cement in assembling the piping, or identify the hazards associated with those activities and materials. The SSSP also did not describe the system that would be used by Western Allied to ensure worker compliance with safe and healthy work practices.
- C. The need to install a pressure gauge was not identified in the SSSP, JSA, or installation drawings for the new piping to be installed by Western Allied. Although installation of the pressure gauge was reportedly discussed during a tailgate meeting on the day of the

explosion, the SLAC UTR failed to ensure that a new JSA was prepared or that the existing JSA was modified to reflect this new task.

Collectively, these deficiencies constitute a Severity Level I violation.

Administrative Appeal

Pursuant to 10 C.F.R. §§ 851.43(b) and 851.44(a), Stanford University may petition DOE's Office of Hearings and Appeals for review of this FNOV within 30 calendar days of receipt of this FNOV. Stanford University's petition must conform with the procedural requirements set forth in 10 C.F.R. Part 1003, *Office of Hearings and Appeals Procedural Regulations*, Subpart G, § 1003.70, et seq. If Stanford University does not petition the Office of Hearings and Appeals for review within 30 calendar days of receipt of this FNOV, Stanford University relinquishes any right to appeal any matter, and the FNOV will constitute a final order.



John S. Boulden III
Acting Director
Office of Enforcement
Office of Health, Safety and Security

Washington, DC
this 3rd day of September 2009