

JSA  
THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY  
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### **Notable Events #69229**

**Event Title:** ENG-17-0726 Inadequate Fall Protection in Central Helium Liquifier (CHL)

**Response Owner:** Henry Robertson (robertsn)

**Category:** C

**Date of Occurrence:** 07/25/2017

**Event Location:** CHL - Bldg. 8

**Date Notable Event Report is Due:** 08/25/2017

### **Short Summary of Event and/or Injuries**

On July 25, 2017, work on the CHL cold box started around 9:00 am. At approximately 11:00 am, a TJSO employee was conducting a walkthrough in the CHL as a subcontractor employee was torquing bolts at an elevated height on the cold box. While conducting this work, the worker was approximately 6 feet out on an I-beam, and tied off to a wire that was installed as a temporary guardrail (see photo). Upon seeing this, the TJSO employee asked them to stop work and safely get down from the elevated workspace. There were two Jefferson Lab employees that were generally overseeing this work and they complied with the request. TJSO then informed the supervisor of this event.

The restart work was planned with JLab employees, Fall Protection Subject Matter Expert (SME), Division Safety Officer (DSO) and the immediate supervisor. The contractors were not permitted to complete the torquing of the remaining bolts that required active fall protection outside a manlift as they did not have the proper fall protection for the newly identified tie off points. After the new work plan (CList) was developed, TJSO was briefed via phone and gave verbal concurrence to the new plan. The DSO requested that the SME remain at the job site and observe the work until completion.

The work finished around 4:15 without further incident.

### **Details of the Event and/or Injuries, including Initial Fact Finding Meeting information: determine the chain of events and timeline**

Timeline -  
7/25/2017:

9:00 - Started crane lift for placement of dome (Requisition # 371162/PO#13A0835508)

10:30 - The SOTR left work area after the lift portion of the job was complete to attend a meeting. Two JLab workers were left to continue with the support effort.

11:00am - TJSO observed a contractor employee in a dangerous position on an i-beam at CHL and declared a Suspend Work. The two JLab employees that were also working on this project complied with the request. The Associate Director of Eng and ESH&Q Management was promptly notified by the TJSO. TJSO asked them to take ownership of the suspend work.

12:30 - Reporting Officer notified and Fact Finding Meeting organized

13:20 - Re-authorization to resume work by Engineering AD and TJSO (CLOG 3479804)

15:30 - Fact Finding meeting held

16:15 - Work in the CHL was complete without further incident. SME was asked to remain at the location until the work was complete.

\*\* To conserve space additional NOTES and comments are in following attachments:

NE ENG-17-0725- Rev 12 tj

## Casual Analysis

### Root Cause

Contractor's safety actions were LTA - Contractor's staff failed to follow their own training and safety plan, and did not properly use their fall protection Personal Protective equipment. The subcontractor's submitted Safety Plan states that their workers will properly use "fall protection."

#### Root Cause Corrective Action

**Action Owner:** Mark Loewus (loewus) **Due Date:** 10/1/2017

Write a letter to Lockwood Brothers identifying the lab's safety expectations on future jobs here at the Lab.

Evidence of Completion: Letter to the contractors

#### Root Cause Corrective Action

**Action Owner:** Mark Loewus (loewus) **Due Date:** 10/16/2017

Have the contractor provide evidence of fall protection training and allow the JLab Subject Matter Expert to review and accept.

Evidence of completion: Email from SOTR approving the training and letter explaining the training.

#### Root Cause Corrective Action

**Action Owner:** Mark Loewus (loewus) **Due Date:** 10/16/2017

Lockwood Brothers employees must be retrained on personal fall arrest protections and anchorage points.

Evidence of completion: Letter from Lockwood

### Contributing Cause

Work Planning was LTA - CTlist (#3486) is a generic document intended to cover all repair work on the cold box.

- The CTLis was written by staff not involved in the work and were not knowledgeable of the specific

safety issues in the CHL.

- Fall protection PPE was not specified as necessary for this effort.
- Ladder use was noted
- A pre-mitigated risk of 3 was identified, but there was no AHA or OSP or Lift Plan attached to the CTlist. Risk code 3 requires an OSP and AHA at a minimum. An updated Lift Plan was used to brief the work crew in the field, but no AHA was documented. Subcontractor submission of an AHA or OSP on fall protection hazards and controls would have allowed an SME to review the work prior to the start.

### **Contributing Cause Corrective Action**

**Action Owner:** Will Oren (oren) **Due Date:** 12/15/2017

Develop and implement a desk top procedure detailing how to use a Cryogenics Task List (CTLis).

Evidence of Completion: Approved Desktop Procedure

### **Contributing Cause Corrective Action**

**Action Owner:** Will Oren (oren) **Due Date:** 01/30/2018

Train Cryogenics employees to the new Cryogenics Task List (CTLis) desktop procedure.

Evidence of completion: Sign in sheet and new procedure

### **Contributing Cause**

Work Planning was LTA - The Cryogenics Group Supervisor was multi-tasking and had delegated responsibilities to workers.

The employees were tasked with getting supplies and watching the flange to ensure no damage occurs while the contractor completed the equipment closure. They were so focused on that portion of their tasks that they did not recognize the improper actions of the contractor staff until TJSO had spotted the issue. There was no continuous safety oversight by JLab staff.

\*Addressed in lessons learned.

### **Contributing Cause**

Work Planning was LTA - Requisition #371162 was cloned from an older requisition.

- With previous success in writing a requisition in this manner, promoted by the use of a clone feature, the requisitioner didn't apply a questioning attitude, and didn't attach appropriate or up to date documents to support the work scope.
- The work described in the purchase requisition was designated as having unmitigated risk code of 2. A risk code of 3 should have been chosen as this work involved the use of Fall Protection. The charge code used for this work did not prompt any Subject Matter Expert review.
- The prescribed code (052-002 for the rental of mobile cranes, material handling equipment and man lifts) in ESH Manual Chapter 6140 "Material Handling Equipment Program" for this kind of work would not have notified the fall protection SME.

### **Contributing Cause Corrective Action**

**Action Owner:** Bill Rainey (wrainey) **Due Date:** 10/30/2017

Interim Corrective Action:

Make changes to PR system to ensure that all requisitions for on-site contract services are routed to ESH&Q for review. \* Be sure to update the referenced manual chapter in the email to

ESH&Q.

Evidence of Completion: Screen shot and sample email to ESH&Q

### **Contributing Cause Corrective Action**

**Action Owner:** Bill Rainey (wrainey) **Due Date:** 11/15/2017

Interim Corrective Action:

Ensure that ESH&Q personnel that are screening each requisition that states there will be work on-site have clear screening expectations (ie. checklist)

Evidence of completion: Expectations- Sign in sheet and checklist

### **Contributing Cause**

Procedures are LTA - The ESH&Q manual chapters are not clear or consistent as to what accounts code should be used when entering a service requisition for crane and rigging work on site. Chapter 6141 Appendix T2 "Procurement Requirements Related to Overhead & Mobile Cranes, Hoists, and Rigging", section 3.1 provides the following codes:

043-028 for the purchase new equipment such as; chain hoists, lever hoists, slings, rigging hardware and BTHLD's

049-024 for the repair of material handling equipment

052-002 for the rental of mobile cranes, material handling equipment and man lifts

- None of these codes are clearly defined for a lift/crane work contract.
- In the Procurement Requisition system no account codes are clearly defined for small construction or service contracts.

Management systems are LTA - Roles and responsibilities were not clear for SOTR, SMEs, and other staff involved in this incident.

- Although this was a contract for services with a risk code of 2 the Subcontracting Officer did not designate a SOTR for specific contract (PO) oversight. The PO was based upon "BPA 12-AOS71" for material handling/crane services by the contractor, however other tasks were contracted for. The "ASSIGNMENT OF SOTR RESPONSIBILITY" and the "ES&H SOTR WORKSHEET" documents designate the SME for Material Handling as the SOTR for all work performed on this BOA.
  - The form being used by procurement to record SOTR assignments is outdated, and was signed after-the-fact with several data fields blank, and makes reference to chapters that no longer exist.
  - The SME for Material Handling thought he had completed his task once he had reviewed the crane and lifting plan. He assumed the role of Material Handling SME and thought that the project lead would be the overall contract SOTR.
  - The ESH Manual Chapter 3410 "Subcontractor Construction Safety" merges the responsibilities of the Requisitioner and the SOTR as if they were by default the same person. This can cause confusion in many cases as the person writing the requisition is not always the project lead.
  - The SOTR did not understand all of his required responsibilities as the information is spread out in many different locations and come from different sources e.g. Procurement training, Procurement website, ESH.
  - The requisition system does trigger general notifications to ESH staff for risk codes 2 and higher, however ESH&Q response to purchase requisition notifications (via e-mail) is not well documented.
- Management systems are LTA - Continuity of qualified SME expertise for open ended construction and services contracts is not well maintained. The BOA that covered this contractor work did not have an official JLab lift/crane SOTR/SME. The previous SOTR had resigned from the facility and the SOTR duties were not reassigned prior to the contract to perform the CHL effort.

Management systems are LTA - The CTLis form does not provide any additional breakdown of hazards when making a YES selection to "Does the task involve working four feet or more above floor level?"

It does not distinguish between fall protection situations and other elevated work. The associated links take the writer to ineffective information.

Management systems are LTA - The CTLis form does not trigger any alerts or additional review when Non-Standard PPE or high risk classifications are selected.

- Work requiring fall protection is automatically rated a Risk Code 3.
- Risk Code 3 work always requires a formal work control document such as a THA or OSP.

### **Contributing Cause Corrective Action**

**Action Owner:** Mary Logue (logue) **Due Date:** 10/16/2017

Conduct an analysis which focuses on the procurement and safe execution of non-construction services:

- 1) Select the members of a cross-laboratory process improvement team

Evidence of completion: List of team members

### **Contributing Cause Corrective Action**

**Action Owner:** Mary Logue (logue) **Due Date:** 10/16/2017

2) the delivery of a charge (Process for designation of SOTR, SOTR responsibilities, subcontractor training related concerns, clear work scope identified in requisition, Subcontractor training requirements) to that team

Evidence of completion: Email to the team

### **Contributing Cause Corrective Action**

**Action Owner:** Steve Smith (sjsmith) **Due Date:** 11/01/2017

3) the delivery of a team charter that describes the team's operations (scope, objectives, deliverables, logistics and decision making process)

Evidence of completion: Email delivery of the charter

### **Contributing Cause Corrective Action**

**Action Owner:** Steve Smith (sjsmith) **Due Date:** 12/01/2017

4) the delivery of an interim report summarizing to-date actions, preliminary decisions and open issues

Evidence of completion: Copy of the interim report

### **Contributing Cause Corrective Action**

**Action Owner:** Steve Smith (sjsmith) **Due Date:** 12/15/2017

5) the delivery of a draft final report that describes the end-state and specific

Evidence of completion: Draft final report

## **Contributing Cause Corrective Action**

**Action Owner:** Steve Smith (sjsmith) **Due Date:** 02/15/2018

6) the delivery of a final report

Evidence of completion: Final report

### **Contributing Cause**

Work planning was LTA - The Cryogenics Group Supervisor, employees, and subcontractors all had training in fall protection, however they failed to recognize and remedy the fall protection hazard in a timely manner according to their training.

Work planning was LTA - Communication occurred between the Fall Protection SME and the Cryogenics Group Supervisor however the conversation did not include all phases of the work. If the contractor's effort had been reviewed in its entirety, or covered by an AHA, no incident may have occurred.

Procedures are LTA - A Management representative from the subcontractor provided a letter stating their workers were trained in fall protection. The JLab service contract requirements on training evidence were satisfied by this letter; however, basic training records information was not provided on the dates of that training, the title or description of the training subject, worker names of the workers trained, instructor's name (if classroom oriented training) or contact hours. The lack of fundamental fall protection awareness draws into question the adequacy of a letter alone as evidence of training qualifications, and has no parity with qualification records expected for crane operators.

Work planning was LTA - The area around the work effort is known to be hazardous. There are no support structures for accomplishing the bolting of the center flange; therefore fall protection was an obvious need. Yet no job specific analysis of approved tie points was made. (The SOTR and SME did review the fall protection issues relating to the relocation and fastening of the upper dome.)

Procedures are LTA - ESH manual Chapter 3410 and its appendices are not comprehensive and can be misleading.

- Although this chapter is supposed to include contracted services it is written primarily for construction projects.
- 3410 Appendix T2 - "Matrix for Determining SSP, Safety Rep, and AHA Requirements" can be misleading as it is based upon perceived complexity of the work rather than real risk.

Management systems are LTA - 3410 Appendix T2 matrix appears to conflict with this document the Division 1 Master Specifications (013529 Safety Health May 2015).

Section D.1. states:

"For each separately definable activity, the Subcontractor shall prepare an Activity Hazard Analysis (AHA) identifying the foreseeable hazards and planned protective measures. Hazards expected on the project which are common to all activities are classified as conventional hazards. Both conventional and special hazards need to be addressed for each definable activity during the course of the project. Additional AHAs shall be required if the nature of work changes or there is a new work task." It does not distinguish between complexity levels as the ESH Manual does.

Training is LTA - SOTR training does not provide clear guidance as to the safety responsibilities of a SOTR. With regards to this incident, the SOTR was not aware of specific details on the Procurement webpage ([https://www.jlab.org/div\\_dept/admin/business/secure/sotr\\_checklist.html](https://www.jlab.org/div_dept/admin/business/secure/sotr_checklist.html)) or in the ESH&Q manual.

## **Contributing Cause Corrective Action**

**Action Owner:** Due Date:

The corrective actions identified above under "Conduct an analysis which focuses on the procurement and safe execution of non-construction services" will address the above contributing causes.

## **Extent of Condition Check**

There may be similar fall protection concerns in other areas of the lab.

**Does this event involve failed equipment?:** NO

**Is there similar equipment in other areas?:** NO

## **Extent of Condition Corrective Action**

**Action Owner:** Bill Rainey (wrainey) **Due Date:** 10/30/2017

Conduct safety observations where known fall protection PPE use is required.

## **Lessons Learned**

### **Lesson Learned**

\*When delegating work to your subordinates, it is imperative that your employees are fully aware of what is expected of them in their absence, specifically safety related hazards (fall protection, chemicals, etc.)

### **Lesson Learned**

When making changes to manual chapters be mindful of the possible adverse ripple effect that may occur with other chapters, processes and systems.

## **Witness Accounts**

NOTE: interviews were taken in front of direct supervisor

Employee #1 interview:

Employee was tasked with answering contractor questions, protecting components, providing supplies (nuts and bolts). He noted that the tie point changed (tightened bolts in star pattern) in the middle of the task. Contractor changed tie off to wire rope barrier for keep-out, which is not intended for fall protection use. Employee#1 was focused on the hardware fit and clearance. He did not see Lockwood employee go out on beam. The employee noticed Lockwood employee position and tie off, just as TJSO alerted him. He understood his overall role but was not focused on project safety. Employee #1 is fully trained and experienced with fall protection. Job walk down discussed various hazards and escape plan if the lift did not go as planned. Employee#1 was chosen to tighten the bolt following the suspend work as he had previous experience with dome and understood the potential installation issues.

Employee #2 interview:

Employee was also tasked with observing Lockwood. He was initially on a lower tie point (approved)

did not notice tie point when Lockwood on out on the i beam (positioned on opposite side of can)  
Employee #2 was tied to lower flange pipe which was an approved tie-off.

General comments:

Lead person did a job walk down on the lift plan (only), discussed emergency exits, and made workers aware of surroundings in tight location.

## **Records, Documents, Pictures, and Other References**

See attachment: CTlist - <http://devweb.acc.jlab.org/CSUEApps/ctlis/task/3486.html>

Purchase Req. #371162

## **Emergency Notifications Made (Subsequent to the Event)**

**ESH&Q Reporting Officer (876-1750):** 07/26/2017

**Other (TJSO):** 07/26/2017

## **Documentation of Findings**

**Notable Event Number:** ENG-17-0726

**CATS Number:** [No Data]

**Lessons Learned Number:** [No Data]

**ORPS Number:** SC--TJSO-JSA-TJNAF-2017-0005

**NTS Number:** N/A

**CAIRS Entry:** N/A

**DOE Cause Code:** A3 Human Performance LTA, B3 Knowledge Based Error, C01 Attention was given to the wrong issues

**ISM Code:** Define the Scope of Work, Perform Work within Controls

## **Signatures**

**Investigation Team:** Tina Johnson (cjohnson)

**Investigation Team:** Scott Thompson (thomps)

**Investigation Team:** Henry Robertson (robertsn)

**Investigation Team:** Steve Neilson (sneilson)

**Investigation Team:** George Perry (gperry)

**Investigation Team:** Mark Loewus (loewus)

**Associate Director / Department Manager:** Will Oren (oren)





NOTICE

DANGER

CAUTION  
NOTICE  
DO NOT WELD ON VESSEL BEFORE SHORTING DISCONNECT

CAUTION



**NOTICE**  
DO NOT  
ON V  
BEFU  
SHORTING DIS

**DANGER**  
Permit Required.  
Confined Space.  
Do not enter.  
Contact: John Kelly x7501

**CAUTION**  
AMBIENT MAGNETIC BEARINGS  
WILL OVERHEAT  
IF NOT COOLED WITH  
LIQUID NITROGEN