

JSA
THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY
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Notable Events #71429

Event Title: FML-17-1004 CHL Roof Conduit Pierced, Causing a Loss of Power to CHL1 4.5K Controls

Response Owner: Rusty Sprouse (sprouse)

Category: F

Date of Occurrence: 10/04/2017

Event Location: CHL1

Date Notable Event Report is Due: 11/06/2017

Short Summary of Event and/or Injuries

On October 4, 2017, cold box controls tripped off, loss of power was first noticed in the Central Helium Liquefier 1 Control Room by the Cryogenics Operations Manager, who noted that lights and controls suddenly dropped. He proceeded to the roof where subcontractors were installing sheets for waterproofing and told them of the outage and that work should stop. The cause of the power failure was determined to be a pierced conduit carrying a 480-volt line. The subcontractors work involved fastening large boards, with a minimum of 16 fasteners per board. Conduit location on the roof had been marked via the normal process, which involved identifying and measuring conduit locations in the interior roof, translating those measurements to the exterior roof, and then marking locations on the exterior roof with a red line, with the intent that the workers would not put fasteners over the marked areas. According to the subcontractor, this is a standard process used on their jobs and the work crew had utilized it many times. Power to identified conduit lines was secured and administratively tagged out. This particular location was properly marked; however, the supervisor had mistakenly told the workers to disregard that line, so they proceeded to install a fastener. Additionally, the conduit line in question had a dedicated breaker and had not been de-energized. Work on the roof was stopped. Facilities Engineering and Accelerator Operations were notified. There were no injuries.

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

On 10/04/2017 around 9:30 am, power to the CHL1 4.5K Cold Box Controls tripped off. This was first noticed in the CHL1 Control Room by the Cryogenics Operations Manager, who noted that lights and controls suddenly dropped. He proceeded to the roof where subcontractors were installing sheets for waterproofing and told them work should stop. Facilities Engineering and Accelerator Operations were notified; Facilities responded immediately and identified the tripped breaker. They then isolated the damaged circuit in panel L2 via resetting and restoring power (once) to CHL-L2 until the damaged circuit was identified.

The cause was a pierced conduit carrying a 480V line that is fed from the same panel that supplies power to CHL1 4.5K Cold Box Controls. The work involved fastening 4' x 8' cover boards with a minimum of 16 fasteners per board and over 6000 for the entire roof. Conduit location on the roof had been marked via the normal process, identifying and measuring locations in the interior roof, translating to the exterior roof, and marking locations on the exterior roof with a red line, with the

intent that fasteners would not be put over the marked areas. According to the subcontractor, this is a standard process used on their jobs and the work crew had utilized it many times. Power to the identified conduit lines was secured and administratively tagged out. This location was properly marked, however according to the two workers installing fasteners, their supervisor had told them to disregard that line, so they proceeded (see picture). This was confirmed by the foreman, who had double checked the conduit location and thought it was clear. The foreman stated that due to height and other equipment in the interior overhead, it is difficult to transfer conduit to exact locations on the roof. It also appears that the conduit line in question had a dedicated breaker and had not been de-energized. When the conduit was pierced, it created a fault current of up to 7700A. The main panel board (which feeds the welding outlet and the controls) trips at 4800A instantaneously. Therefore, the whole panel lost power. The breaker responded as it should.

The language aspect was checked by the lead investigator. All members of the crew are not fluent in English (spoke very broken English). There was a bilingual worker working with them. The lead investigator is fluent in Spanish. She determined that the instructions were clear and well understood enough that it had no impact.

In addition to the loss of Controls power, there was venting and loss of Helium 10 minutes after loss of power. Turbines and compressors were checked and appeared to have no damage. The workers remained on the roof during part of the work stoppage and descended in an orderly fashion when requested. There were no injuries.

The LOTO was performed by a Facilities Electrical Engineer and Facilities electrician earlier in the week. All exhaust fans were de-energized at this time as well as other equipment on the roof with power. The exhaust fans all are fed from the same motor control center, MCC-A. The Facilities Electrical engineer did not de-energize additional items in the cold box room as they were not working in that section at that time. When work proceeded to the cold box room the SOTR called the Facilities electrician to confirm the exhaust fans had been de-energized in the room. SOTR was told the fans were de-energized. Neither he nor the Facilities Electrician knew that power lines were also present for non-roof equipment. Drawings with conduit locations do not exist. . It is not standard practice to show actual conduit runs on electrical drawings, thus the SOTR proceeded with the work. The Facilities Electrical Engineer was not informed.

A blind penetration permit would not have helped in this case because the conduit that was damaged was visible

Casual Analysis

Root Cause

Electrical Engineering SME was unaware of and not included in the decision to secure power. The SOTR did not notify nor include the Electrical Engineering SME in this decision, which per the FML process, would've prompted a walkdown by the SME and thus awareness of the roof lain power lines. The SOTR instead notified the FML electrician to de-energize the ceiling exhaust fans; the electrician was unaware of the presence of the struck line. Thus, the line was not de-energized.

Root Cause Corrective Action

Action Owner: Rusty Sprouse (sprouse) **Due Date:** 12/22/2017

Brief SOTRs on the event, scope of corrective actions to be taken, and any actions they should follow in the interim

Root Cause Corrective Action

Action Owner: Rusty Sprouse (sprouse) **Due Date:** 09/30/2018

Develop a comprehensive, standard practice / procedure for when electrical outages are warranted, how to conduct them, who reviews and approves, and how they are documented and retained. Include guidance on penetrations, when to perform local electrical outages vs entire building electrical outages, and the appropriate SMEs who should be included.

Extent of Condition Check

Cryo has recovered the system and resumed normal operations. An independent team of Cryo, Operations and FML personnel did a secondary walkthrough to identify all conduit lines and locked them out prior to the contractor resuming work.

Does this event involve failed equipment?: NO

Is there similar equipment in other areas?: NO

Lesson Learned

Plan / coordinate future outages with Operations and Engineering to better utilize planned Accelerator down time.

Witness Accounts

See body of NE

Records, Documents, Pictures, and Other References

see attachments

Emergency Notifications Made (Subsequent to the Event)

ESH&Q Reporting Officer (876-1750): 10/04/2017

Other (TJSO): 10/04/2017

Documentation of Findings

Notable Event Number: FML-17-1004

CATS Number: NE-2017-08

Lessons Learned Number: 1035

ORPS Number: SC--TJSO-JSA-TJNAF-2017-0008

NTS Number: NA

CAIRS Entry: NA

DOE Cause Code: A5B4C01 Communication LTA/Verbal Communication LTA/Communication

between Work Groups LTA

ISM Code: Develop and Implement Hazard Controls

Signatures

Investigation Team: Steve Smith (sjsmith)

Investigation Team: Steve Suhring (suhring)

Investigation Team: Celia Whitlatch (whitlatc)

Investigation Team: Jonathan Creel (creel)

Investigation Team: Paul Powers (powersp)

Investigation Team: Ed Winslow (winslow)

Associate Director / Department Manager: Rusty Sprouse (sprouse)