



Department of Energy
Thomas Jefferson Site Office
12000 Jefferson Avenue
Newport News, Virginia 23606

August 1, 2007

Mr. Craig R. Ferguson
Associate Director for ESH&Q
Thomas Jefferson National Accelerator Facility
12000 Jefferson Avenue
Newport News, VA 23606

Dear Mr. Ferguson:

The enclosed Surveillance report covers the Site Office's review of the Laboratory's compliance with the electrical safety requirements contained in the National Fire Protection Association (NFPA) 70E, conducted June 18-20, 2007. We are committed to improving the quality of these reviews, and we encourage the Lab to provide feedback on ways to improve the efficiency and utility of these assessments.

For all Findings identified in the report, the Laboratory is expected to submit to the Site Office a corrective action plan by August 31, 2007. Corrective action plans are expected to minimally identify each Finding, a brief description of the actions taken or planned, the name of the responsible party, and the projected date of closure. Within the corrective action plan, please include the disposition or proposed course of action for each Observation identified in the report.

If there are questions pertaining to this Surveillance, please contact Steve Neilson of my staff at extension 7215.

Sincerely,


James A. Turi, Manager
Thomas Jefferson Site Office

Enclosure

cc w/encl:
C. Leemann
M. Dallas

**U.S. Department of Energy
Oak Ridge Office**



**Final Report
Assistance Visit
Electrical Safety–National Fire Protection Association
70-E Assessment at
Thomas Jefferson National Accelerator Facility
June 19 – 21, 2007**



Larry D. Perkins

7/24/07
Date



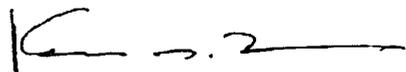
James W. Craven

7/24/07
Date



James D. Lovette

7/26/07
Date



Karl G. Moro

7/24/07
Date

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ACRONYMS

ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
ES&H	Environment, Safety, and Health
ESH&Q	Environment, Safety, Health, and Quality
FIND	Finding
FR	Flame-Resistant
MRI	Mechanical Resources, Inc.
NFPA	National Fire Protection Association
NP	Noteworthy Practice
NRTL	Nationally Recognized Testing Lab
OBS	Observation
ORO	Oak Ridge Office
PPE	Personal Protective Equipment
SOP	Standard Operating Procedure
TJNAF	Thomas Jefferson National Accelerator Facility or Jefferson Lab (also referred to as JLab)
TJSO	Thomas Jefferson Site Office, DOE Office of Science

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EXECUTIVE SUMMARY

At the request of the U.S. Department of Energy (DOE) Thomas Jefferson Site Office (TJSO), an Oak Ridge Office (ORO) sponsored team visited the Thomas Jefferson National Accelerator Facility (TJNAF) or Jefferson Lab (also referred to as JLab) on June 19-21, 2007, to conduct an assessment of the TJNAF Electrical Safety Program and implementation of National Fire Protection Association (NFPA) 70-E requirements. The team assisting the TJSO with this assessment consisted of Larry D. Perkins and James W. Craven, ORO; Karl G. Moro, Chicago Office; and Douglas Lovette, DOE technical support contractor.

The following nine findings (FIND), four observations (OBS), and one noteworthy practice (NP) were identified during the review:

FIND-01	Electrical insulated gloves are not being tested in accordance with regulatory requirements.
FIND-02	Clothing worn by personnel during energized electrical work underneath flame-resistant (FR) arc-rated apparel is not always 100 percent natural fiber, and FR-rated apparel available for energized electrical work does not always include pants or bibs to cover the employee below the waist.
FIND-03	Voltage testing is not being performed using the appropriate category meter for the circuits and equipment to which they are attached.
FIND-04	Voltage verifications are not being performed when initiating lockout/tagout on a system that has been locked out under administrative configuration control.
FIND-05	The 600 volt draw-out circuit breakers are being opened to provide electrical protection; however, the breakers are not being racked out, and no other electrical isolation device is being opened.
FIND-06	JLab employees and subcontractors are performing work under protection (Hold-Order) provided by Virginia Power Company which is not a JLab recognized employee protection system.
FIND-07	TJNAF electrical training programs do not specifically address all of the training requirements as stated in the regulatory codes and regulations needed for qualified, electrical workers.
FIND-08	Unqualified electrical workers and other individuals have not been trained to recognize the electrical hazards associated with the work they perform.
FIND-09	During battery maintenance activities, not all specifically designed personal protective equipment (PPE) is being worn for this type of hazard.
OBS-01	The Mechanical Resources, Inc., subcontract (effective May 25, 2007) does not require implementation of the JLab lockout/tagout procedure and does not require that employees have NFPA 70-E training prior to performing electrical work.

OBS-02	TJNAF has not completed the calculations for shock and arc flash hazard analysis and labeling of site equipment (as identified in the 2005 Office of Science Energized Electrical Work Review); and the recommendation to formalize implementation of NFPA 70-E requirements as a project with milestones, deliverables, and a schedule has also not been implemented.
OBS-03	Voltage verification is not being performed until after the locks/tags are being applied to the isolation device which may not be the safest location for employees to perform voltage verification.
OBS-04	Some equipment is being obtained by JLab that is not approved by a Nationally Recognized Testing Lab; and the equipment is not being reviewed and approved by the contractor to ensure an effective level of safety, and that accepted codes and regulations are met, and the equipment and material is being installed in a manner that is inconsistent with its listing and labeling.
NP-01	Six JLab employees are studying, on their own, to obtain an electrical inspector's license, as required for the inspection of electrical equipment and systems.

1.0 INTRODUCTION

At the request of the U.S. Department of Energy (DOE) Thomas Jefferson Site Office (TJSO), the Oak Ridge Office conducted an evaluation of the Thomas Jefferson National Accelerator Facility (TJNAF) or Jefferson Lab (also referred to as JLab) electrical safety program and implementation of National Fire Protection Association (NFPA) 70-E, *Standard for Electrical Safety in the Workplace*, on June 19-21, 2007. The evaluation process consisted of three primary elements: (1) reviewing applicable sections of the TJNAF Environment, Safety, Health, and Quality (ESH&Q) Manual and other site documentation including training programs; (2) interviewing TJNAF personnel and subcontractors; and (3) conducting a walkthrough of site facilities to verify compliance with applicable requirements and standards. The primary subcontractors providing support to the TJNAF laboratory facilities (Mechanical Resources, Inc., and Harris Electrical Service) were also evaluated. During the review, nine findings (FIND), four observations (OBS), and one noteworthy practice (NP) were identified.

2.0 SUMMARY OF RESULTS

2.1 Personal Protective Equipment

2.1.1 Insulated Gloves

Interviews were conducted with TJNAF and subcontractor personnel to determine the type of personal protective equipment (PPE) employees were using for protection from electrical shock and flash hazards, as well as the manner in which the PPE was being used. Personnel were observed using protective gloves and flame-resistant (FR) clothing, and PPE available for use and in storage were examined at various locations throughout the site.

Rubber insulating gloves meeting the requirements of American Society for Testing and Material (ASTM) D120, *Standard Specification for Rubber Insulating Gloves*, and leather protectors meeting the requirements of ASTM F696, *Standard Specification for Leather Protectors for Rubber Insulating Gloves and Mittens*, were available for use by site personnel. The gloves were being procured by various personnel and from multiple vendors. There was no central procurement process or specifications in place, and no control over how long the gloves remained on site prior to issue. The time the gloves were in use was being tracked by various methods. In some cases, the date the gloves were issued was being maintained; in other cases, the employees were recording the date that the package of gloves was opened, either by writing on the glove or packaging material. Once issued or opened, the gloves were kept in service for a period of six months; and after that time, the gloves were discarded. Discussions with employees indicated that boxes of gloves were purchased and could remain in storage for several months/years prior to being issued.

Some of the gloves were stamped with a test date from the vendor; others had test documentation available; and some were purchased without test documentation. A pair of Class 00 gloves used during voltage verification on June 19, 2007, was stamped with a test date of February 2006. When asked about testing, the employee stated that the gloves had been issued recently, and that he would be notified within six months to exchange the gloves.



Figure 1. Electrical Rubber Insulating Glove

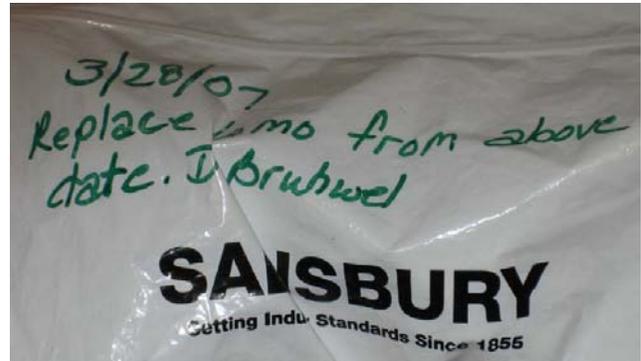


Figure 2. Glove Packaging Showing Date

One individual indicated that he had used Class 00 gloves without the leather protectors, and when questioned about continued use, he stated that the gloves would continue to be used until the end of the six-month period, then they would be disposed.

Insulated gloves are not being electrically tested in accordance with regulatory requirements (29 Code of Federal Regulations [CFR] 1910.137 (b)(2)(viii) and Table I-6). The standard states that gloves shall be tested before the first issue and every six months thereafter. The Table I-6 footnote in the CFR states that if the insulating equipment has been electrically tested but not issued for service, it may not be placed into service unless it has been electrically tested within the previous 12 months. **(FIND-01)** ASTM F496, *Standard Specification for in-Service Care of Insulating Gloves and Sleeves*, Paragraph 7.1, specifies the same test frequency. In addition, Paragraph 8.7.4 states that rubber insulating gloves that have been used without protectors shall not be used with protectors until given an inspection and electrical retested. **(FIND-01)**

2.1.2 Flame-Resistant Clothing

Employees have been provided flame-resistant clothing for use where there is a potential exposure to an electrical arc flash above the threshold incident-energy level for a second-degree burn. Clothing providing various levels of protection is available for use. The issued FR clothing was being stored in duffle bags with gloves and head and face protective equipment, and the clothing appeared to be in good condition.

Interviewed employees were aware of the requirements to use FR clothing for the protection from potential arc flash; however, multiple employees expressed the position that it did not matter what was worn under the FR clothing. Clothing worn by personnel during energized electrical work underneath the flame resistant arc-rated apparel is not always 100 percent natural fiber. FR-rated apparel available for energized electrical work does not always include pants or bibs to cover the employee below the waist.

- a) Man-made flammable and melting fabrics are being worn under the FR arc-rated apparel. [NFPA 70-E 130.3(b), NFPA 70-E 130.7(C)(12)(c), (NFPA 70-E Annex B.1.4, 29 CFR 1910.269(l)(6)(iii)] **(FIND-02)**
- b) Normal work clothing covering below the waist is being worn without FR arc-rated pants or bibs. [NFPA 70-E 130.7(C)(12)(d), (NFPA 70-E Annex B.1.4, 29 CFR 1910.269(l)(6)(iii)] **(FIND-02)**

2.2 Electrical Test Instruments - Meters

During interviews with site personnel, electrical test instruments used for verification of zero energy were discussed. During these discussions, a significant number of personnel were not aware of the “category” designation of their instruments. Several personnel were asked to show the meters they used and specifically show what they would use to check for the absence of voltage on a 480v circuit. In several instances, the meter presented was rated as a Category II meter or was an older meter that did not have any category rating. Both 29 CFR 1910.334(c)(3) and NFPA 70-E 110.9(A) require that test instruments, equipment, and their accessories shall be rated for the circuits and equipment to which they will be connected. Category I and II meters are designed for use on electronic equipment and are required for some applications; however, they are not designed or rated for use on power distribution equipment in an industrial setting. **(FIND-03)**



Figure 3. Electrical Meter



Figure 4. Electrical Meter

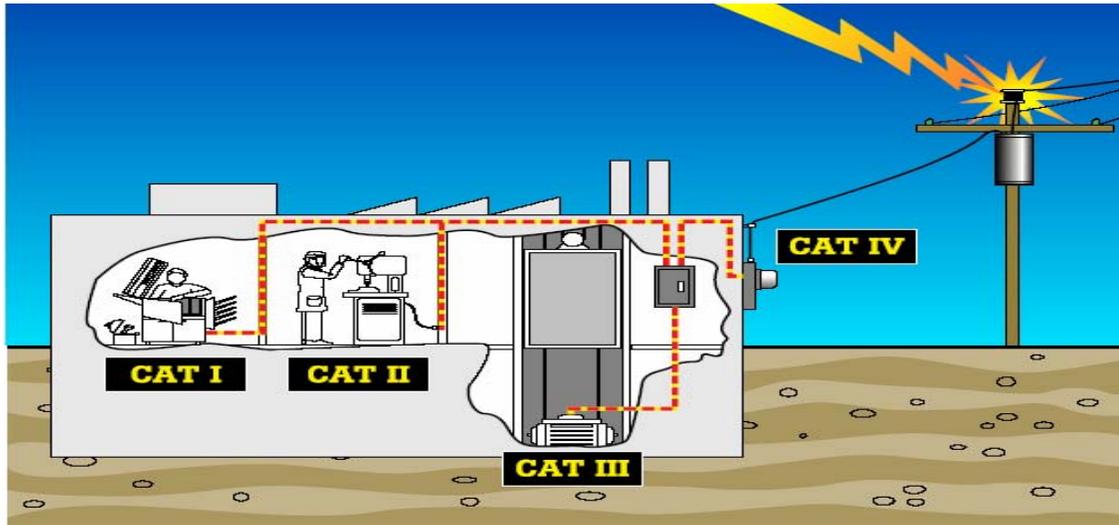


Figure 5. Chart for Category Meter Use Locations¹

2.3 Lock, Tag, and Try (Lockout/Tagout)

2.3.1 Interface between Lockout/Tagout and Administrative Control

During interviews with employees, two primary interfaces between lockout/tagout and the administrative control process were discussed. The first involved an employee placing his/her personal lockout onto a multi-lock hasp where an administrative lock was in place and then proceeding to work on the system without performing all the steps of the lock, tag, and try process, including absence of voltage verification.

The second situation involved an employee placing his/her personal lock on the system to perform work; and at the end of the shift, removing their personal lock and applying a division administrative lock to the system if the work had not been completed. In this situation, the employee stated that he would return to complete the work, remove the administrative lock, and place his personal lock on the system, or overlock the system with his personal lock, and resume work without performing an absence of voltage verification.

In both of these situations, the absence of voltage verification is not being conducted in all cases prior to the employee performing work on the system, as required by 29 CFR 1910.147(d)(6) and 1910.333(b)(2)(iv) and NFPA 70-E 120.1(5), 120.2(A), and 120.2(F)(2)(f)(4). **(FIND-04)** In addition, the TJNAF ESH&Q Manual Chapter 6111 requires that all energy sources be secured in accordance with JLab lockout/tagout procedures when transitioning from administrative configuration control to maintenance/service lockout/tagout.

¹ Fluke® presentation at the DOE Electrical Safety Conference in June 1999



Figure 6.
Lockout/Tagout



Figure 7. Lockout/Tagout

2.3.2 600 Volt Draw-Out Breakers

In interviews with site personnel, the process for locking out 480 volt draw-out breakers was discussed.

The 600 volt class draw-out circuit breakers opened to provide electrical protection are not being racked out, and no other electrical isolation device is being opened. A mechanical interlock on the draw-out breaker is being operated, and locks/tags are being installed on the interlock.

Due to previous managerial/training guidance, 600 class volt draw-out circuit breakers are being opened to provide electrical protection; however, they are not being racked out. A mechanical interlock on the breaker is being locked and tagged. No other electrical isolation device is being opened. [NFPA 70-E 120.2(E)(6), 70-E 120.2(F)(2)(k)(3), and 70-E Annex B.1.4 and 29 CFR 1910.333(b)(2)(ii)(B) and 1910.333(b)(2)(iii)(D)] **(FIND-05)**



Figure 8. 600 Volt Breaker



Figure 9. 600 Volt Breaker

2.4 Virginia Power Work Permit Interface

JLab employees and subcontractors perform work under protection (Hold-Order) provided by Virginia Power Company. This is not a JLab recognized employee protection system.

When there is a requirement for the Virginia Power Company to provide electrical protection for JLab or subcontractor employees to perform work, there is no JLab/Virginia Power Company recognized system to provide this protection. Conversely, if JLab was requested by Virginia Power Company to provide protection for Virginia Power Company employees to perform work, there is no multi-employer system to provide this protection. Interface, training, and tagging requirements, to name a few, need to be formally established between JLab and the power provider. [NFPA 70-E 120.2(D)(4), 70-E 120.2(D)(5), and 70-E Annex B.1.4 and 29 CFR 1910.269(m)] (FIND-06)

2.5 Training

2.5.1 Qualified Electrical Training

The TJNAF electrical training programs (SAF 100, Environment, Safety, and Health [ES&H] Orientation, SAF 603A, Electrical Safety Awareness for Electrical and Electronics Workers, and SAF 603N, NFPA 70-E Electrical Safety) were reviewed during this assessment. SAF 100 provided little information about the hazards associated with electricity, other than to say that these types of hazards were one of the most common type of hazards found at the Laboratory. SAF 603A and SAF 603N were directed toward those Laboratory employees who would be expected to perform electrical work; i.e., NFPA 70-E requirements. These

courses did not specifically address all the training requirements specified in 29 CFR 1910.332 (b) (1) and (3) for qualified workers. **(FIND-07)**

2.5.2 Unqualified Electrical Training

During interviews conducted and records reviewed, it was discovered that unqualified electrical workers and other individuals do not have electrical safety training in accordance with 29 CFR 1910.332 (b)(2) and NFPA 70-E 110.6 (D)(2). This was verified by the review of the Individual Training Profile of the employee who operates the Laboratory's mobile crane which found no electrical safety training to be required. As an unqualified electrical worker, this individual needs to be aware of the allowable approach distances of the boom of the mobile crane when operating it in the vicinity of overhead power lines and conductors. It was also discussed during interviews that painters do not receive unqualified electrical training. The Laboratory has not ensured that its unqualified electrical workers have been trained to recognize the electrical hazards associated with the work they perform as required by NFPA 70-E 110.6 (D)(2) and 29 CFR 1910.332 (b)(2). **(FIND-08)**

2.6 Battery Maintenance

During battery maintenance activities, only gloves and safety glasses are being worn by employees. There are periodic requirements to perform battery maintenance on the battery banks that provide direct current control power to the electrical distribution equipment. At present, when water or electrolyte is being added or the electrolyte condition is being tested, only gloves and safety glasses are being worn. Other PPE specifically designed to be worn for this type of hazard is needed. [NFPA-70-E 320.8] **(FIND-09)**

2.7 Voltage Verification

Voltage verification is not being performed until after the locks/tags are being applied to the isolation device. This may not allow employees to perform voltage verification in the safest location.

The JLab lockout/tagout procedure specifically requires that the locks/tags be applied to the system before the verification for the absence of voltage is performed. This does not always allow employees the flexibility to perform these voltage verifications at the safest location for the employee. **(OBS-3)**

2.8 Approved and Accepted Equipment

JLab is obtaining equipment that is not approved by a Nationally Recognized Testing Lab (NRTL). This equipment is not being reviewed and approved by the contractor to provide an effective level of safety where NRTL equipment is not used, or the accepted codes and regulations are not met. In addition, equipment and material installed in a manner that is not consistent with its listing and labeling is not being evaluated and approved by the contractor. **(OBS-04)**



Figure 10. Electrical Power Source



Figure 11. Electrical Outlet

2.9 Subcontract – Requirements Flow down

Flow down of electrical safety requirements to TJNAF subcontractors was evaluated. The Jefferson Science Associates subcontract and subcontract modifications for the Mechanical Resources, Inc. (MRI), were reviewed to verify requirements. Modification 030 for subcontract Number JSA-05-C1007, effective May 25, 2007, contained the following discrepancies:

- Section 1.5 B. r. of the modification listed required program elements for the Subcontractor's Safety Plan and identified by an asterisk those activities for which JLab has site-specific, mandatory practices and permits. Lockout/tagout was not identified in this list, although MRI is required to follow the JLab procedure.
- Section 1.6 A lists the training classes personnel are required to attend prior to working on site. The NFPA 70-E course is not identified on this list, even though the MRI employees must take this course in order to perform electrical work.

Although the MRI employee's are performing lock, tag, and try in accordance with the current TJNAF procedure and the MRI employees have taken the TJNAF NPFA 70-E training course, the latest contract modification does not reflect these requirements. **(OBS-1)** Modification to the MRI contract does not accurately identify the electrical procedures and training required for the subcontractor's employees to perform electrical work on site.

2.10 Office of Science Energized Electrical Work Review - February 7-11, 2005

It was the recommendation of the Office of Science Review Team performing the Energized Electrical Work Review at JLab in February 2005 that, due to the numerous NFPA 70-E requirements and the potential complexity for undertaking full lab-wide implementation of those requirements, the Laboratory project implementation of NFPA 70-E, . Specifically, the team recommended that milestones, schedules, and deliverables be established, and that the January 31, 2005, JLab *NFPA 70-E Implementation/SLAC Accident Investigation Review and Action Plan*, be implemented as part of the project. At that time, a significant amount of work had been accomplished, but it was evident to the review team that the state of implementation varied across the Laboratory and that the various means of implementation were not always compliant. During this review it was determined that the February 2005 recommendation had not been acted upon. Though it was found that implementation of NFPA 70-E requirements has progressed and many of these requirements are gradually being institutionalized, this review determined that some of the significant NFPA 70-E requirements have not yet been completed.

An example of a significant NFPA 70-E requirement not being completed is the calculations for shock and flash hazard analyses as required by NFPA 70-E 110.8 (B)(1). During the February 2005 review, it was noted that JLab was conducting the required hazard analysis calculations for Mode 2 work; however, JLab work control documents for Mode 2 work did not include the results of the hazard analysis calculations for required boundaries. As such, a recommendation was made that JLab document the analyses (shock and flash hazards) and results specified by NFPA 70-E 110.8 (B)(1) for Mode 2 work.

During this review, varying percentages of completion were reported on the progression of the shock and flash hazard analyses. Based on individual interviews and from notations in the minutes from the Electrical Safety Committee, this completion ranged anywhere from 30 percent to 95 percent. No one could give an accurate response to the question of the state of completion. It was found that the percentage of completion varied by division, and it also varied by whether the percentage of completion included just completing the analyses or completing the analyses and posting the results by labeling affected equipment. During site walkthroughs, a significant portion of the electrical equipment was observed that was not labeled with specific arc flash hazard information. **(OBS-02)**

2.11 Noteworthy Practice

Six JLab employees are studying, on their own, to obtain an electrical inspector's license, as required for the inspection of electrical equipment and systems. **(NP-01)**

3.0 FINDINGS, OBSERVATIONS, AND NOTEWORTHY PRACTICES

3.1 Findings

- FIND-01** Electrical insulated gloves are not being tested in accordance with regulatory requirements.
[29 CFR 12910.137(b)(2)(viii), Table I-6; ASTM F496 Paragraphs 7.1 and 8.7.4]
- FIND-02** Clothing worn by personnel during energized electrical work underneath flame-resistant arc-rated apparel is not always 100 percent natural fiber, and FR-rated apparel available for energized electrical work does not always include pants or bibs to cover the employee below the waist.
[NFPA 70-E 130.3(b), 70-E 7(C)(12)(c), 70-E Annex B 1.4; 29 CFR 1910.269(l)(6)(iii)]
[NFPA 70-E 130.7(C)(12)(d), 70-E Annex B 1.4; 29 CFR 1910.269(l)(6)(iii)]
- FIND-03** Voltage testing is not being performed using the appropriate category meter for the circuits and equipment to which they are attached.
[29 CFR 1910.334(c)(3) and NFPA 70-E 110.9(A)]
- FIND-04** Voltage verifications are not being performed when initiating lockout/tagout on a system that has been locked out under administrative configuration control.
[29 CFR 1910.147(d)(6), 1910.333(b)(2)(iv); NFPA 70-E 120.1(5), 70-E 120.2(A) and (F)(2)(f)(4)]
- FIND-05** The 600 volt draw-out circuit breakers are being opened to provide electrical protection; however, the breakers are not being racked out, and no other electrical isolation device is being opened.
[NFPA 70-E 120.2(E)(6), 70-E 120.2(F)(2)(k)(3), 70-E Annex B.1.4; 29 CFR 1910.333(b)(2)(ii)(B), 1910.333(b)(2)(iii)(D)]
- FIND-06** JLab employees and subcontractors are performing work under protection (Hold-Order) provided by Virginia Power Company which is not a JLab recognized employee protection system.
[NFPA-70-E 120.2(D)(4), 120.2(D)(5), 70-E Annex B.1.4; 29 CFR 1910.269(m)]
- FIND-07** TJNAF electrical training programs do not specifically address all of the training requirements as stated in the regulatory codes and regulations needed for qualified, electrical workers.
[29 CFR 1910.332 (b) (1) and (3)]
- FIND-08** Unqualified electrical workers and other individuals have not been trained to recognize the electrical hazards associated with the work they perform.
[29 CFR 1910.332 (b) (2) and NFPA 70-E 110.6 (D) (2)]
- FIND-09** During battery maintenance activities, not all specifically designed personal protective equipment is being worn for this type of hazard.
[NFPA-70-E 320.8]

3.2 Observations

- OBS-01** The Mechanical Resources, Inc., subcontract (effective May 25, 2007) does not require implementation of the JLab lockout/tagout procedure and does not require that employees have NFPA 70-E training prior to performing electrical work.
- OBS-02** TJNAF has not completed the calculations for shock and arc flash hazard analysis and labeling of site equipment (as identified in the 2005 Office of Science Energized Electrical Work Review); and the recommendation to formalize implementation of NFPA 70-E requirements as a project with milestones, deliverables, and a schedule has also not been implemented.
- OBS-03** Voltage verification is not being performed until after the locks/tags are being applied to the isolation device which may not be the safest location for employees to perform voltage verification.
- OBS-04** Some equipment is being obtained by JLab that is not approved by a Nationally Recognized Testing Lab; and the equipment is not being reviewed and approved by the contractor to ensure an effective level of safety, and that accepted codes and regulations are met, and the equipment and material is being installed in a manner that is inconsistent with its listing and labeling.
[NFPA 70-E 400, NFPA 110.2, and NFPA 110.3]

3.3 Noteworthy Practices

- NP-01** Six JLab employees are studying, on their own, to obtain an electrical inspector's license, as required for the inspection of electrical equipment and systems.

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Appendix A

Personnel Interviewed

Electrical Safety Committee Member
Facilities and Logistics Management
Mechanical Resources, Inc., Supervisor
Harris Electric Services Electrician
Engineering Division Electrical Safety Committee Member
Mechanical Resources, Inc., Technician
Electrical Safety Physics Division Electrical Safety Committee Member
ESH&Q Department Safety Representative for Facility Maintenance
Electrical Engineering System Group Manager
Accelerator Operations Research and Development Electrical Safety
Committee Member
Facilities Management Mechanical Engineer
Facilities and Logistics Management Electrical and Mechanical Coordinator
Engineering Division Electrician
Facilities and Logistics Management Subcontract Officer Technical
Representative
Contracting Officer Technical Representative
Mechanical Resources, Inc., Technician

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Appendix B

Records Reviewed

- **TJNAF Environment, Safety, Health, and Quality Manual**
 - Chapter 2240, *Jefferson Lab ES&H Committees*, Revised August 17, 2006
 - Appendix 2210-T1, *Current EH&S Staff Assignments*, Revised June 16, 2006
 - Chapter 2410, *Applicable Regulations and Contractual Commitments*, Revised April 21, 2006
 - Appendix 2410-T1, *Jefferson Lab Hazard Issue List*, Revised April 21, 2006
 - Appendix 2410-T2, *Work Smart Standards Set*, Revised April 21, 2006
 - Chapter 3210, *Hazard Identification and Characterization*, Revised December 20, 2006 (including all appendices)
 - Chapter 3320, *Temporary Work Permits*, Revised December 20, 2006
 - Chapter 3420, *ESH&Q Aspects of Procured Services & Construction*, Revised October 1, 2002
 - Chapter 4200, Appendix 4200-T3, *Individual ESH&Q Training Plan*. Revised July 13, 2006
 - Chapter 6110, *Lock, Tag and Try (Lockout/Tagout)*, Revised March 2, 2007 (including all appendices)
 - Chapter 6111, *Administrative Configuration Control Using Locks and Tags*, Revised March 2, 2007
 - Chapter 6200, *Jefferson Lab’s Electrical Safety Program*, Revised August 17, 2006
 - Chapter 6210, *General Electrical Safety*, Revised December 9, 2003 (including all appendices)
 - Chapter 6220, *AC Electrical Distribution Equipment Safety*, Revised October 18, 2005
 - Chapter 6230, *Electronic Equipment Safety*, Revised October 19, 2005
 - Chapter 6240, *Electrical and Electronic Equipment Construction and Maintenance Practices*, Revised December 9, 2004
 - Chapter 6620, *Personal Protective Equipment*, Revised January 26, 2005 (including all appendices)
- *TJNAF 10 CFR 851 Worker Safety and Health Protection Program (WSHPP)*, Revision 1, May 21, 2007
- Jefferson Lab Facilities Management Excavation and Wall Penetration Procedures, *Excavations and Blind Penetrations into Walls and Floors*, Revised February 1, 2005
- PHY-05-004 Standard Operating Procedure (SOP), *Hall A Power Supply Test and Maintenance*, Issue Date June 8, 2005
- PHY-05-001 SOP, *Testing/Repair of Voltage Dividers Building 96D*, Issue Date February 4, 2005
- PHY-05-002 SOP, *Testing/Repair of 120VAC Electronic Chassis, Hall B*, Issue Date February 4, 2005
- PHY-05-003 SOP, *DVCS System Danfysik Power Supply LOTO for Mode 1 Work*, Issue Date February 8, 2005
- PHY-05-004 SOP, *DVCS System Instrumentation Rack LOTO for Mode 1 Work*, Issue Date February 8, 2005
- PHY-05-016 SOP, *Hall C HMS Power Supply Test and Maintenance*, Issue Date November 10, 2005

- A-02-013-SOP, *100 kW Klystron High Power Amplifier Maintenance and Safety*, Issue Date July 23, 2002
- A-04-008-SOP-Rev.1, *500 KV Gas Insulated Power Supply Maintenance & Safety*, Issue Date August 12, 2005
- A-05-003-SOP, *SOP for Magnet Hook Up and Operation of a Danfysik Power Supply in the Magnet Measurement Facility*, Issue Date January 25, 2005
- A-06-014-SOP, *Standard Operating Procedure (SOP) for Testing or Adjusting Magnet Power Supplies While Fully Powered*, Issue Date May 2006
- ACC-PR-01-010, *Utility Chassis Replacement Procedure*, Rev. 2, March 15, 2004
- ACC-PR-01-011, *Box Power Supply Safe Out Procedure*, Rev 2, December 19, 2005
- ACC-PR-04-015, *Cathode Power Supply & High Power Amplifier Safe Out Procedure, Box Power Supply Safe Out Procedure*, Rev 4, December 22, 2005
- 40 MVA Substation Switching Procedures, No Date
- Preventative Maintenance Tasks and Schedule and Preventative Maintenance Procedures, No Date
- Experiment Readiness Certificate for Experiments #E05-017/E06-009/E04-001 in Hall C, April 30, 2007
- Mechanical Resources Inc. Accident Prevention/Safety Program for Jefferson Lab Mechanical Preventative Maintenance and Repair Services Contract Number SURA-05-C1007, July 1, 2005
- Harris Electrical Service Company Safety Policy, January 27, 2003
- TJNAF July 2007 Training Schedule, No Date
- TJNAF Electrical Safety Awareness Training Overheads, Author Ed Martin, updated February 1, 2006
- Training Presentation PowerPoint Slides, *Electrical Safety at Jefferson Lab*, Author Paul Powers, No Date
- Training Presentation PowerPoint Slides, *Electrical Safety at Jefferson Lab, NFPA 70-E for Subcontractors*, Author Paul Powers, No Date
- Training Presentation PowerPoint Slides, *Lock, Tag and Try at JLab*, Todd Kujawa, No Date
- Qualified Electrical Workers Spreadsheet, No Date
- Cryogenics Group Electrical Worker Equipment Qualification Spreadsheet, Updated June 8, 2007
- Jefferson Science Associates, LLC, Subcontract JSA-05-C007, Mechanical Resources, Inc., excerpts, March 2005
- Jefferson Science Associates, LLC, Subcontract JSA-05-C007, Mechanical Resources, Inc., Modification 24, Effective Date December 7, 2006
- Jefferson Science Associates, LLC, Subcontract JSA-05-C007, Mechanical Resources, Inc., Modification 30, Effective Date May 25, 2007