

Take 5 for Safety

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BROOKHAVEN
NATIONAL LABORATORY

a passion for discovery



LANL Electrical Accident May 3, 2015

- **LOS ALAMOS, N.M. —Los Alamos National Laboratory workers were injured in an electrical accident Sunday**
- **Eight other employees were also taken to Los Alamos Medical Center**
- **Seven of the employees were later released, but one remains in the hospital for observation**
- **A laboratory employee was burned while working at an electrical substation during preventive maintenance operations at the Los Alamos Neutron Science Center (LANSE proton accelerator)**
- **The employee was taken offsite for medical treatment and is listed in critical condition**
- **Eight other employees were also taken to Los Alamos Medical Center. Seven of the employees were later released, but one remains in the hospital for observation**
- **The cause of the accident is under investigation**

BNL Arc Flash Accident 2006

- **April 14, 2006 at ~1020**
- **C-AD Building 1006A Mechanical Loft at STAR**
- **Engineer operates 480 V 400 amp disconnect switch**
- **Arc flash injuries:**
 - **1st degree burns to head, face, chest, and hands**
 - **1st and 2nd degree burns to forearms**
- **Switch panel destroyed**

BNL Arc Flash Accident 2006



BNL Arc Flash Accident 2006



Possible Cause for Accident

- **High transient voltage**
 - Arcing ground fault on ungrounded delta system
- **Damaged phase C supply cable**



BNL Arc Flash Accident 2006

DOE Type B Investigation Corrective Actions

- **Converted from an ungrounded 480-volt power system to a high-resistance grounded system**
- **Increased the sensitivity of ground-fault detecting relays**
- **Connected all ground-fault monitoring devices to remote alarms in the C-AD Main Control Room**
- **Improved the rigor of testing, commissioning and operational readiness reviews for electrical systems**
- **Verified all equipment necessary for safe and reliable operation of the system meets design standard**
- **Developed, trained, and implemented formal work controls to address receipt of initial ground-fault alarms at Main Control Room**
- **Required the existing preventive maintenance inspection program to include fused-disconnect switches and ground-fault relays**
- **Perform pre-job briefings before jobs that involve the operation of circuit breakers for power distribution**

Alternate Possible Cause for Accident

Damaged switch



Undamaged switch



Foreign object across phases

BNL Arc Flash Accident 2006

C-AD and HU Sub-Contractor Corrective Actions

- Assumed the 480 V switches mechanically failed and replaced or took out of service these types of switches (NOTE: GE recalled these type Spectra switches several years after the accident)
- Implemented Human Performance (HU) Training and HU Practices
- Implemented NFPA 70E PPE requirements

HU Identified 8 Error Traps for the 2006 Accident

- Time Pressure
- Distractive Environment
- High Workload
- First Time Evolution
- First Working Days After Days Off
- One-Half Hour After Wake-up or Meal
- Vague or Incorrect Guidance
- Overconfidence
- Imprecise Communications
- Work Stress
- Fatigue
- Peer Pressure
- Multi-tasking
- Off-normal Conditions

HU Practices

- **Consolidate requirements as close to the worker as possible – don't make people go get them, or expect them to know them off the top of their head (e.g., PPE labels on the disconnect switches)**
- **Recognize the differences between research and operations and how to manage these differences safely (e.g., work planning for experiments and work planning for operations)**
- **Apply PPE rules by area or location versus by action or activity (e.g., PPE rules for entry to machine shops)**
- **Provide appropriate PPE at the locations needed**
- **Educate personnel on recognition of error traps, error likely situations and latent organizational weaknesses and the impact they have on performance**
- **Improve individual's capability to recognize when a task begins to deviate from the expected path – and the actions needed at that time**
- **Place more emphasis on preparation to implement corrective actions from significant events before rolling out the implementation strategy**