

Information Bulletin

Inadequate Planning Causes Power Outage

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Tracking No: 667

Summary: An electrician performing an energized electrical work package with an uninsulated probe caused a short which tripped a breaker providing conditioned power to critical laboratory equipment. When making work planning decisions to perform energized electrical work, it is important to utilize the appropriate tools for the activity and ensure all possible safety considerations are taken into account. Considerations should include human factors such as work area physical restrictions, risks and consequences of performing the work while energized or deenergized, and whether the equipment to be used is adequate for the job to be performed.

Discussion of Activities: Electrical metering was being performed to determine power loading on six facility transformers. The task to connect and disconnect the probes was performed with the transformers energized and an Energized Electrical Work Permit was in place. Two transformers had been successfully metered (~30 days each) and the instrumentation was attached to a third smaller transformer having just completed its 30 days. While removing one voltage probe, in preparation to monitor the next



transformer, a short occurred between the secondary and primary lugs causing half of the metal teeth of one probe to vaporize, and trip the circuit breaker on the primary side of the transformer. The open breaker caused a conditioned power loss to twelve laboratory rooms.

The conditions in this event demonstrate that humans get into patterns which lead them into potential areas of failure. Most of those involved perceived the work as routine and required little additional planning beyond identifying the scope of the work. The planning of the work could have recognized that not all of the transformers were the same. As such, the smaller one would possibly introduce hazards which didn't exist with the other larger transformers. The workers could have performed an assessment of potential hazards which may have been overlooked in the planning stages.

Analysis: The smaller transformer, upon which the event occurred, was approximately two-thirds the size of the other transformers. It was located in a walkway area which restricted

worker access to the equipment. These factors created an awkward work area which increased the potential for human error. The work was performed with the equipment energized. There was inadequate recognition that if the work was performed incorrectly, equipment would be inadvertently shut down as a result. No contingency was made for an unanticipated loss of power in this event. The hazard analysis did not account for the potential for human error. There was no indication a hazard analysis or work planning took into consideration the different sizes of the transformers. No controls were considered to compensate for this increased hazard. Additionally, there was no indication that the work plan recommended the use of insulated probes to conduct the work activity.

When the equipment probes (used for the measurements) were connected to the lugs the probe ends are not shielded/insulated to mitigate shorting events. Insulated probes were not used because the attached probes came with the meter and had been successfully used on the first two transformers. Insulated probes that would have worked existed in the shop.

Recommended Actions: Initial actions/recommendations for this event include:

- Re-evaluate the hazards associated with any work activity. The hazard analysis needs to consider that the final barrier on the work activity is an individual, who due to PPE, physical configuration of the equipment, and tools being used, could make an error at a critical step (as demonstrated by this event)
- Do not perform energized work unless shutting down the system would create more hazards than not shutting down the system unless there is no feasible way to shut the system down and perform the work - i.e., UPS batteries, etc.
- Develop a 'contingency' plan that identifies the appropriate actions for loss of power, controlled shutdown, and restart of identified laboratory analytical instruments that are deemed critical equipment
- Use the appropriate tool for the level of hazard (i.e., insulated leads) to mitigate the hazards

Cost Savings/Avoidance: The hard costs included replacing an instrument tube and the damaged probes - \$2,038. The costs associated with this event such as the critique, Human Performance Improvement investigation, work package reviews, briefings, procedure modifications, and laboratory equipment restart activities were not evaluated.

Work Function: Conduct of Operations - General, Work Planning

Hazards: Electrical, Personal Injury

ISM Core Functions: Analyze Hazards and Risks

Keywords: electrical work planning

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References: None