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# MODE 0 AND MODE 1 ELECTRICAL WORK RESTART AT PSC – MAKEUP SESSION



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# CURRENT STATUS

## What can we do, what is still on hold

- Non-hazardous Electrical Work
  - $< 50\text{VAC}$  or  $\geq 50$  volts AC and  $\leq 5$  mA
  - $< 100\text{VDC}$  or  $\geq 100$  VDC and  $\leq 40\text{mA}$
  - No stored Energy in Excess of Table 2 in LMS-POL-69
- Restart of Hazardous Electrical Work
  - Equipment or wiring is already in the electrically safe work condition (Mode 0)
  - Placing equipment or wiring into the electrically safe work condition including Zero Voltage Verification (Mode 1)

Mode	Description of Work
0	Equipment or wiring is already in the electrically safe work condition
1	The task of placing the equipment or wiring into the electrically safe work condition including zero voltage verification
2	<del>Performing only testing, measuring, troubleshooting, and/or calibration while energized (Includes visual inspection of energized enclosures)</del>
3	<del>Energized work and any task beyond mere testing, measuring, troubleshooting, and/or calibration; includes any manipulative work and any use of tools beyond that of a tester</del>

# RESTARTING MODE 0 AND MODE 1 WORK

- Compensatory actions are required, this is at a Laboratory level
  - QEW employees were reviewed by each division with a critical eye
    - Some upgraded
    - Some eliminated
      - Current list available on APS Electrical Safety Web page
  - Work Approval required - Covered by a procedure, technical note, or WCD
  - PSC Pre-Job briefing REQUIRED
  - Mode 1 checklist completed in ADDITION to pre-job
  - Trained independent Qualified Electrical Worker Observer present for all Mode 1 work
  - Work Authorization from the line REQUIRED prior to start

# WORK APPROVAL

## Group Leaders and Schedulers must

- Examine proposed work
  - Covered by a procedure, technical note (in ICMS), or WCD
    - That work is scoped as described
    - That hazards and controls are fully identified
    - That proper PPE is called out
    - That equipment needed is described
    - Level of QEW is proper for tasks
- Review the approval dates of the work document (must be < 3 yrs.)
  - IF complex LOTO is involved review the procedure being used in conjunction with the review above if separate procedure(s) are used

# PRE-JOB BRIEFING

## Same as restart of operations

- PSC Pre-Job briefing form is completed on APS web page
  - Mode 1 work **MUST** have indication that the ANL-1202, *Mode 1 Electrical Work Job Briefing* has been completed by checking the box
  - Name of the QEW Observer entered (field has been added)
    - Observer will complete ANL-1205 prior to and during Mode 1 work
  - In approved field enter name of the person who **AUTHORIZED** the work
    - For work supporting the APS Upgrade there may be two names

Edit a Pre Job Briefing Form

Division Name: XSD

Group Name: Detectors (DET)

Pre-Job Brief: Testing, troubleshooting, assembly

Conducted By: Antonino Miceli

Location: 431-Z-030

WR/Ticket #:

Job Description: Testing, troubleshooting, assembly and repair of electronics in the XSD Detectors Electronics Lab (431-Z-030)

Is an ANL-1202 Required:

Name of QEW Observer: \_\_\_\_\_

Task assignments /scope of work:

Review of procedures / guidance: ESAF: 83-431-Z030-2017-XSD/DET

CCWP Required?:

List the hazards or potential hazards if any:

- 1.) Physical/mechanical
- 2.) Electrical
- 3.) High pressure compressed air

What can be done to mitigate the hazards:

- 1.) Proper PPE, Steel toe shoes, etc.
- 2.) Verification of no storage energy; Use LOTO when appropriate, especially if job is over several days. When assembling chassis, use liquid electrical tape over exposed 120 VAC.

Approver: Antonino Miceli

Return to  
Mike Edelen  
when  
completed

**Follow ISM principles:** Define the scope of the work; Analyze the hazards; Develop and implement controls; Perform work within the controls; Feedback and improvement

<input type="checkbox"/> Extended duration from _____ to _____		<input type="checkbox"/> One-time use only	
Division: _____	Building: _____	Room/Area: _____	Person in Charge: _____
Job supervisor/responsible engineer: _____		Date start: _____	Expiration date: _____
Description of work (Scope) to be done: _____ _____			
Description of circuit/equipment: _____ _____			
<b>Electrically Safe Work Condition (NFPA-70E 2015, 120.1, 130.2, ESH 9.1)</b>			
<input type="checkbox"/> Reference all applicable drawings, diagrams, identification tags, etc.			
<input type="checkbox"/> Field verify the possible energy sources			
<input type="checkbox"/> Determine all possible sources of electrical supply to the equipment including stored energy (capacitors, inductors, etc.)			
<input type="checkbox"/> Simple LOTO: isolation device ID _____		<input type="checkbox"/> Complex LOTO (written procedure) _____	
<b>Results of Shock Hazard Analysis (NFPA-70E 2015 130.4, LMS-PROC-321)</b>			
Maximum voltage: _____	Glove voltage rating: _____ (Inspect gloves before use, check certification date)		
Limited approach boundary: _____ (in.)	Restricted approach boundary: _____ (in.)		
<input type="checkbox"/> Insulated tools and equipment required			
<b>Results of Arc Flash Hazard Analysis (NFPA-70E 2015 130.5, LMS-PROC-287)</b>			
Incident energy: _____ Cal/cm <sup>2</sup>	Arc flash boundary: _____ (in.)	Working distance: _____ (in.)	
Arc flash PPE category: _____			
<input type="checkbox"/> Required additional PPE (list if required): _____			
Additional personnel: _____	<input type="checkbox"/> Safety watch	<input type="checkbox"/> Additional person	<input type="checkbox"/> Observer
Qualified electrical workers level _____ (must be trained per ESH 9.1.6, qualified, and have full knowledge of equipment)			
<input type="checkbox"/> Capacitor training required as determined by JHQ			
Line manager must determine if the work is to be completed by skill of the worker or by procedure.			
<input type="checkbox"/> Skill of the worker	<input type="checkbox"/> Procedure required: Procedure no: _____		
<input type="checkbox"/> See attachment for added information, special requirements, procedures, WCDs or written work plans.			
<b>APPROVALS:</b>			
Hazard analysis performed by: _____		Sign & Date: _____	
ESH Coordinator: _____		Sign & Date: _____	
Electrical SME: _____		Sign & Date: _____	
Line Supervisor/Group Leader/ Foreman: _____		Sign & Date: _____	
Dept. Mgr or Line Mgr (For QEW Level 2 & 3) _____		Sign & Date: _____	
<b>Person in Charge (PIC) deliver the job briefing: must include the scope of work, hazard analysis and required controls.</b>			
Printed or typed name: _____		Sign & Date: _____	
<b>Authorized Workers who have attended required job briefing by the person-in-charge.:</b>			
Printed or typed name(s): _____		Signature(s) & Date(s): _____	
_____		_____	
_____		_____	
_____		_____	
_____		_____	

# OBTAIN AUTHORIZATION

## You may now proceed

- This is given once you have an approved process, procedure, work control document, technical note or work tool
- Line management, or designee, provides
  - Work direction
  - Work authorization
- Workers need to know
  - Limits of authorization (what scope is authorized)
  - Expectations to pause or stop work if
    - Scope creep begins
    - Hazards are different (can be a different location changes them)
    - Controls are ineffective or unworkable
    - Unclear of limitations of authorization, work direction or approved process



## Electrical Safety Field Observation Checklist



**Observer  
MUST be  
from a  
different  
work group**

Safety Observer		Date
Job/Task Observed		
Electrical Safety Touchpoints	Safety Observer Notes	
<b>PART 1: DAILY PPE INSPECTION</b>		
<b>1. Voltage Glove Inspection</b> <ul style="list-style-type: none"> <li>Properly stored upon arrival</li> <li>Voltage class (max usage and max test) and type</li> <li>Inspection date and serial number</li> <li>Visual inspection inside and out</li> <li>Glove inflation test</li> <li>Leather glove inspection</li> <li>Cotton liner inspection</li> </ul>	<ul style="list-style-type: none"> <li>Rubber stored with cuffs down in bag</li> <li>Class (00) 500vac-750vdc, (0) 1kvac-1.5kvdc, (1) 7.5kvac-11.25kvdc, (2) 17kvac-25.5kvdc, (3) 26.5kac-39,75kvdc, (4) 36kvac-54kvdc</li> <li>6-month period of use; retest after 6 months</li> <li>Reference LMS-PROC-253</li> </ul>	
<b>2. Voltage Meter &amp; Tools Inspection</b> <ul style="list-style-type: none"> <li>Category rating</li> <li>Inspection of leads</li> <li>Inspection of meter</li> <li>Test meter fuses</li> <li>Perform live test of meter</li> <li>Understand meter indications</li> <li>Verify rating of insulated tools</li> <li>Check physical condition of insulated tools</li> </ul>	<ul style="list-style-type: none"> <li>Look for NRTL and double-insulating symbols. <input type="checkbox"/></li> <li>Verify Category Rating III or IV.</li> <li>Visually inspect the leads for damaged insulation, and the case for cracks and damage.</li> </ul> <p>Certain meters have the capability to check the internal fuse when reading amps. Check fuse condition by following:</p> <ul style="list-style-type: none"> <li>Set meter to <math>\Omega</math>.</li> <li>Plug lead into the V port and insert in the A port. Reading should be near 0.</li> <li>If there is an mA port, insert the lead. Reading should be near 10k.</li> <li>An OL reading in either case indicates a blown fuse.</li> </ul>	
<b>3. Arc Flash PPE Inspection</b> <ul style="list-style-type: none"> <li>ATPV or Ebt Rating</li> <li>Condition of clothing</li> <li>Condition of faceshield/hood</li> <li>Condition/Rating of hard hat</li> <li>Safety Glasses</li> <li>Boots</li> <li>Hearing Protection</li> </ul>	<ul style="list-style-type: none"> <li>Inspect arc flash PPE before each use.</li> <li>Look for damage such as rips, cuts, abrasion, scratches, cracks, and perforations.</li> <li>Verify rating of hard hat E rated 20kv. G rated is general use 2.2kv rated.</li> <li>Canal insert for hearing protection.</li> </ul>	

Level of Qualified Electrical Worker	Job Briefing and Documentation Requirements	Mode of work (0, 1) Note 1.	Review (R)/Approval (A) Required	Independent Observer (Additional Qualified Person) Requirements for Field Observations (Y/N). Note 2.
<b>Level 1 QEW</b> <ul style="list-style-type: none"> <li>• 60 Hz AC: <ul style="list-style-type: none"> <li>○ &lt; 230 volts; transformer &lt; 125 kVA (or no arc flash hazard)</li> </ul> </li> <li>• DC and Batteries: <ul style="list-style-type: none"> <li>○ ≥ 100 volts and available short circuit current ≤ 500 amps</li> </ul> </li> <li>• Capacitors: <ul style="list-style-type: none"> <li>○ ≤ 400 volts and &lt; 10,000 J</li> </ul> </li> <li>• Sub-RF and RF: <ul style="list-style-type: none"> <li>○ ≤ 250 volts and ≤ 500 amps</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Verbal Job Briefing including scope of the work and review of LO/TO (No written documentation required)</li> </ul>	Mode 0	<ul style="list-style-type: none"> <li>• QEW 1 or 2 (R)</li> <li>• Line Supervisor or Foremen (Verbal Approval) (A)</li> </ul>	<ul style="list-style-type: none"> <li>• NO, Not Required</li> </ul>
	<ul style="list-style-type: none"> <li>• ANL Mode 1 Electrical Work Job Briefing Form</li> <li>• Procedure for all complex LO/TO</li> </ul>	Mode 1	<ul style="list-style-type: none"> <li>• ESH Coordinator (R)</li> <li>• Electrical SME (R)</li> <li>• Line Supervisor, Group Leader or Foreman (A)</li> </ul>	<ul style="list-style-type: none"> <li>• YES (Worker and independent observer)</li> <li>• Complete Electrical Safety Field Observation Checklist</li> </ul>
<b>Level 2 QEW</b> <ul style="list-style-type: none"> <li>• 60 Hz AC: <ul style="list-style-type: none"> <li>○ ≤ 600 volts</li> <li>○ &gt; 600 volts that is of facility (not utility) type</li> </ul> </li> <li>• DC and Batteries: Any</li> <li>• Capacitors: Any</li> <li>• Sub-RF and RF: Any</li> </ul>	<ul style="list-style-type: none"> <li>• Verbal Job Briefing including scope of the work and review of LO/TO (No written documentation required)</li> </ul>	Mode 0	<ul style="list-style-type: none"> <li>• QEW 2 (R)</li> <li>• Line Supervisor or Foremen (Verbal Approval) (A)</li> </ul>	<ul style="list-style-type: none"> <li>• NO, Not Required</li> </ul>
	<ul style="list-style-type: none"> <li>• ANL Mode 1 Electrical Work Job Briefing Form</li> <li>• Procedure for all complex LO/TO</li> </ul>	Mode 1	<ul style="list-style-type: none"> <li>• ESH Coordinator (R)</li> <li>• Electrical SME (R)</li> <li>• Line Supervisor, Group Leader or Foreman (R)</li> <li>• Department Manager or Line Manager (A)</li> </ul>	<ul style="list-style-type: none"> <li>• YES (Two-person and independent observer)</li> <li>• Complete Electrical Safety Field Observation Checklist</li> </ul>

■ **Mode 0 – Equipment or wiring has already been placed in the electrically safe work condition.**

■ **Mode 1 – The work is to place the equipment or wiring in the de-energized electrically safe work condition including zero voltage verification (ZVV).**

- Note 1: Cord and plug equipment may be placed in the electrically safe work condition (Mode 0) by unplugging and controlling the sole plug so it cannot be plugged in, as long as there is no stored hazardous energy inside the unit and the cord and plug is the only source of hazardous energy to the unit.

**THIS DOES NOT REQUIRE AN ANL Mode 1 Electrical Work Job Briefing Form.**

- Note 2: The Independent Observer must have completed Electrical Safety Observer training and should be a QEW outside of the group that planned the work. If this is not feasible, the line manager must approve the observer. The observer must be qualified to the appropriate level per LMS-POL-69 and is an addition to the number of workers required by the applicable LMS Procedure for the work.
- Note 3: When two persons are required review the applicable LMS Procedure to determine if the person is required to be a safety watch or an additional person. Electrical LMS Policies and Procedures are listed below for reference.
  - Argonne [ESH-9.1](#), *Electrical Safety Program – General Electrical Safety*
  - Argonne [ESH-9.2](#), *Electrical Safety Program – Electrical Worker Safety*
  - Argonne [ESH-9.3](#), *Electrical Safety Program – Electrical Systems and Equipment*
  - Argonne [ESH-7.1](#), *Lockout/Tagout Program*
  - Argonne [LMS-PROC-185](#), *Simple Lockout/Tagout*
  - Argonne [LMS-PROC-208](#), *Determining Work Controls for Electrical Work on Batteries*
  - Argonne [LMS-PROC-230](#), *Determining Work Controls for Electrical Work on 60 Hz AC*
  - Argonne [LMS-PROC-248](#), *Determining Work Controls for Electrical Work on DC*
  - Argonne [LMS-PROC-249](#), *Determining Work Controls for Electrical Work on Capacitors*
  - Argonne [LMS-PROC-250](#), *Determining Work Controls for Electrical Work on AC Other Than 60 Hz*
  - Argonne [LMS-PROC-253](#), *Testing, Procuring, and Using Voltage-Rated Gloves*
  - Argonne [LMS-PROC-287](#), *Performing an Electrical Arc Flash Risk Assessment*
  - Argonne [LMS-PROC-294](#), *Performing Electrical Work Involving Shared Neutrals*
  - Argonne [LMS-PROC-321](#), *Performing an Electrical Shock Risk Assessment*

# QUESTIONS

## Contact your supervisor or ESH Coordinator

- There are other resources available to us
  - Electrical SME's
  - Electrical Safety Committee members
  - Authority Having Jurisdiction (Mike Edelen)
  - Infrastructure Services staff
- If you aren't sure DON'T proceed, this is not an option, it is an EXPECTATION
  - Pause work
  - Ask for direction
  - Call for assistance