IMPLEMENTATION OF WORK PLANNING AND CONTROL AT THE APS

PAUL ROSSI, JOHN CONNOLLY AND GEORGE SRAJER
AGENDA

- Background
- Work Planning and Control Process and Implementation
- Main Features
- Examples
- Schedule
- Laboratory Requirement on Reporting High Risk Work
- Q&A
BACKGROUND

- User Operations were paused on July 25, 2017 as a result of two electrical incidents in the Photon Sciences (PSC) Directorate.
- The investigations revealed significant weaknesses in the implementation of integrated safety management (ISM) for work in PSC.
- Following the restart of user operations on July 28, PSC Associate Lab Director/APS Director required that all non-office work in PSC must be covered by a procedure, technical note, ESAF or work tool.
- For work that is not already described in above categories, a Work Control Document (WCD) must get generated.
  - WCD in many cases broadly encompasses task-specific activities with a well-defined scope.
- Before work commences, the WCD has to be reviewed and approved, work authorized, all workers must have requisite training and a pre-job briefing has to be completed.
Procedure based on multiple other sources of information, from DOE handbooks to DOE lab and lightsource procedures.

Procedure codifies what has been already been occurring since major Lab events in 2017 and APS stand-down / work pause:
- Reinvigorating WP&C through use of Work Control Documents (WCDs)
- Application of pre-job briefs at point of work, before work commences

Read and sign training targeting non-office work only individuals in Photon Sciences.
Revised APS work planning and control process incorporates basic Integrated Safety Management (ISM) principles to provide a consistent and integrated approach to performing all types of work at the APS, with easy to follow reference tables.

All APS work classified into 3 categories:

- **Experimental work**
- **Contractor/construction work**
- **Facility technical tasks (aka “other work”)**

Procedure also contains essential elements:

- Suspend and stop work authority,
- Clear identification of approval versus authorization,
- Work Planning & Control (WP&C) roles and responsibilities by work function.
### Experimental work:
- ESAF remains as focal, controlling mechanism for experiments and lab work

**Experimental Work**, see [APS Experiment Safety Reviews](#) for additional information

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<tbody>
<tr>
<td>The experiment Spokesperson completes the description sections of the experiment on an ESAF</td>
<td>Experiment Spokesperson identifies the hazard classes sections on an ESAF and submits the ESAF</td>
<td>Upon ESAF submittral, Hazard Control Plan (HCP) is automatically generated</td>
<td>Safety 1) Beamline or APS Group designated approver and APS Experiment Safety Review Board 2)</td>
<td>Experiment Authorization (EA): 1) APS Floor Coordinator (FC) generates an EA form 2) FC confirms controls in place with experiment On-site Spokesperson (OSP) 3) OSP signs-off EA form 4) FC posts EA at work area</td>
<td>Experiment executed by persons identified on ESAF Beamline staff, Floor Coordinators, and APS ESH personnel provide oversight</td>
<td>FC removes EA and updates run log</td>
<td>End of Run form</td>
</tr>
</tbody>
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### Contractor/construction work:
- APS Work Planning Checklist along with Contractor Job Safety Analysis (JSA) and Work Entry Clearance, overseen by IS Group (APS Site Operations)

**Construction**, see [Contractor and Construction Services](#) for additional information

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</thead>
<tbody>
<tr>
<td>Requestor submits requirements to APS Site Operations Group (ASO): ASO completes a Work Project Checklist (WPC)</td>
<td>ASO lists hazards on a Job Safety Analysis (JSA)</td>
<td>For each JSA hazard, the ASO identifies the mitigating controls on the JSA</td>
<td>Sign-offs required per the Work Project Checklist are obtained.</td>
<td>ASO and AES Division Director (or designee)</td>
<td>Per contracts and applicable JSA ASO provides oversight</td>
<td>ASO update facility records</td>
<td>Feedback to ASO</td>
</tr>
</tbody>
</table>
APS WORK PLANNING AND CONTROL IMPLEMENTATION

- Facility technical tasks:
  - Approved WCD is focal, controlling mechanism; either Standard Operating Procedure (SOP)-based or task-based WCDs.
  - Rigor classification from creation of WCD
  - Pre-job brief requirement, then work authorization

Facility Technical Tasks, see Work Request guide and Argonne’s WP&C software application for additional information
IMPACT

- Most of the work is covered by two processes that have been developed and implemented for many years:
  - Experimental Work – ESAF
  - Contractor/Construction work

- For the third category of Facility Technical Tasks:
  - Implementing training and reporting:
    - Work Planning and Control
    - Work Control Documents
    - Pre-job brief requirement and work authorization
    - Rigor classification
Approved Work Control Document (WCD) is focal, controlling mechanism and has 2 options:

- Standard Operating Procedure (SOP)-based or
- Task-based WCDs.

Rigor classification from creation of WCD

Pre-job brief requirement, then work authorization
AVAILABLE APPROVED GENERIC TASK-BASED WCD

- **Beamline Common Work** (Low and Moderate Rigor)
  - Work activities associated with the experiments and instrumentation used on the Advance Photon Source beam lines, and the associated support, control and common areas within the APS.
  - Does not include any work that is covered under an approved ESAF or radiation protection/personnel protection systems.

- **Installation of Beamline Components** (Low Rigor)
  - Work associated with the installation of beamline components
  - Does not include any operations that require a permit, electrical installation, or blind penetrations

- **Machine Tool Operation** (Low Rigor)
  - Operation of APS Machine Tools within APS facilities
  - Does not include the machining of hazardous materials.
BEAMLINE COMMON WORK

- Task 1 - Beam Line, Experimental Hutches, and Common Areas
  - The scope covers activities and instrumentation within beam lines, experimental hutches and associated control and common areas.
  - Includes beam line instrumentation used to transport x-ray beams from the APS shield wall to the experimental enclosures.
  - Typical beam line activities include:
    - vacuum work
    - alignment & mechanical adjustments
    - electronic interfacing on equipment such as slits, mirrors, monochromators, beam position monitors, cryo-cooled optics…. 
    - associated motion control, robotic, laser, mechanical and electrical systems
BEAMLINE COMMON WORK (CONT’D)

- **Task 2 - Dry Lab Activities**
  - For mechanical and electrical (non-energized) work on components and equipment to support experimental activities.
  - Typical work includes assembly, repair, and testing of beam line equipment.
  - This includes activities such as:
    - mechanical work with hand tools and/or small power tools
    - fabricating and testing signal and motor cables
    - configuration and repair of beam line equipment such as vacuum pumps, motors, actuators, amplifiers, compressors, and sample stages
    - soldering of electrical connections
    - testing of software communication with beamline equipment
    - unpacking and assembly of beamline components
BEAMLINE COMMON WORK (CONT’D)

- Task 3 - Wet Lab Activities
  - Activities in chemical laboratory space including sample preparation and testing of beamline components
  - This includes activities such as:
    - cleaning samples using common solvents such as acetone, ethanol or methanol
    - mounting of samples using various common adhesives
    - grinding of metallic powders using a mortar and pestle
    - loading sample cells or mounts
    - heating of samples and/or adhesive mixtures using a hot plate or kiln
    - testing new beam line equipment such as sample cooling refrigeration units
    - unpacking and assembly of beam line components and user-provided instrumentation
WORK OUTSIDE OF GENERIC TASK-BASED WCD

- Creation of a Work Control Document in the ANL Work Planning and Control System
  - WPC assist in define the controls required based on pre-defined hazard trees
    - much like ESAF
- Pre-Job Briefing
- High Risk Reporting, if applicable
### Example Not Covered by GENERIC WCD

- Ion Chamber Battery Replacement

#### Worker Package

<table>
<thead>
<tr>
<th>Title</th>
<th>TEST - Ion Chamber Battery Replacement - TEST</th>
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<tbody>
<tr>
<td>Document No.</td>
<td>57004.0</td>
</tr>
<tr>
<td>Status</td>
<td>SME Review as of 05/16/2018</td>
</tr>
<tr>
<td>Complexity Determination</td>
<td>Simple</td>
</tr>
<tr>
<td>Planned Start Date</td>
<td>08/01/2018</td>
</tr>
<tr>
<td>Planned End Date</td>
<td>08/01/2020</td>
</tr>
<tr>
<td>Scope Summary</td>
<td>Replace the 300V battery on an Ion Chamber</td>
</tr>
<tr>
<td>Type</td>
<td>Task-based Hazard Analyses</td>
</tr>
<tr>
<td>Rigor Level</td>
<td>High</td>
</tr>
<tr>
<td>Approving Division</td>
<td>PSC</td>
</tr>
<tr>
<td>Approving Department</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>NEPA Number</td>
<td>ASO-CX-265 - In-door bench-scale research projects and conventional laboratory operations generic CX</td>
</tr>
<tr>
<td>Person in Charge</td>
<td>Rossi, Paul</td>
</tr>
</tbody>
</table>

#### Task Summary

<table>
<thead>
<tr>
<th>Task #</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ion Chamber Battery Replacement</td>
</tr>
</tbody>
</table>

#### Attachments

<table>
<thead>
<tr>
<th>File Name</th>
<th>Date</th>
<th>Attached By</th>
</tr>
</thead>
</table>

#### Permits Summary

<table>
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<tr>
<th>Code</th>
<th>Date</th>
<th>Attached By</th>
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<tr>
<td>ANL-211 Energized Electrical Work Permit</td>
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<tr>
<td>Title</td>
<td>TEST- Ion Chamber Battery Replacement - TEST</td>
<td></td>
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<td>-------------</td>
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<td>Document No.</td>
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<td>Status</td>
<td>SME Review as of 05/16/2018</td>
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</table>

**Task 1: Ion Chamber Battery Replacement**

<table>
<thead>
<tr>
<th>Task Description</th>
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</thead>
<tbody>
<tr>
<td>Remove the battery pack from service by disconnecting the BNC connector</td>
</tr>
<tr>
<td>Open the battery enclosure</td>
</tr>
<tr>
<td>Remove and recycle the old battery</td>
</tr>
<tr>
<td>Replace the battery and re-install the enclosure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Planned Start Date</th>
<th>Planned End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/01/2018</td>
<td>08/01/2020</td>
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</tbody>
</table>

**Scope Limits**

Battery terminals must be taped when removed for recycling.

**Task Attachments**

<table>
<thead>
<tr>
<th>File Name</th>
<th>Date</th>
<th>Attacher</th>
</tr>
</thead>
</table>

**Lessons Learned**

2017-ANL-020 - Less than Adequate Oversight Resulted in a Student Receiving a Shock

**Response to Unplanned Events**

Stop work immediately and contact the supervisor. In case of emergency dial 911.

**Worker Proficiencies**

Not Applicable

**Work Instructions**

- Remove the battery pack from service by disconnecting the BNC connector
- Open the battery enclosure
- Remove and recycle the old battery
- Replace the battery
- Re-install the enclosure
- Connect the battery pack to the Ion Chamber
<table>
<thead>
<tr>
<th>Hazard Detail</th>
<th>Controls</th>
<th>Training</th>
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<tbody>
<tr>
<td>/Physical safety hazards/</td>
<td>safety watch</td>
<td>ESH114 Lockout/</td>
</tr>
<tr>
<td>Electrical hazards/Category 2 - DC/Where voltage is &gt; 100 and ≤ 400 volts/</td>
<td>see Energized Electrical Work</td>
<td>Tagout Training</td>
</tr>
<tr>
<td>And current is &gt; 40 mA and ≤ 500 A</td>
<td>Permit ANL 211 Energized Electrical Work Permit</td>
<td>ESH376 Electrical Safety Training for QEW1</td>
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<tr>
<td>Mode 3 - Energized Work</td>
<td></td>
<td>ESH376C 2015 Updates to 70E R&amp;D Course</td>
</tr>
<tr>
<td>Task Hazard Relationship</td>
<td>no jewelry</td>
<td></td>
</tr>
<tr>
<td>Ion Chamber Battery Replacement</td>
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<td></td>
</tr>
<tr>
<td>/Physical safety hazards/</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical hazards/Category 4 - Batteries (Note: for batteries/</td>
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<td></td>
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<tr>
<td>battery banks &gt; 100 volts, also refer to DC (Category 2) which</td>
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<tr>
<td>may require additional controls)</td>
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<tr>
<td>Where power is ≥ 100 and &lt; 1000 watts (all Modes)</td>
<td></td>
<td></td>
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<tr>
<td>Task Hazard Relationship</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replace Ion Chamber Battery</td>
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</tbody>
</table>
## Task 1 - Ion Chamber Battery Replacement

<table>
<thead>
<tr>
<th>Hazard Description</th>
<th>Controls</th>
<th>Training</th>
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</thead>
<tbody>
<tr>
<td>Physical safety hazards/Hand tool hazards/Non-powered hand tool</td>
<td>do not carry hand tools in pockets - carry in hands, tool pouches, bags, or boxes</td>
<td></td>
</tr>
<tr>
<td>GENERIC (use for all hand tools - select this in addition to those below, if appropriate)</td>
<td>do not place tools where they can cut, fall on, or trip someone</td>
<td></td>
</tr>
<tr>
<td>Task Hazard Relationship</td>
<td>Ion Chamber Battery Replacement</td>
<td>follow LMS-PROC-153</td>
</tr>
<tr>
<td></td>
<td></td>
<td>only use tools you have been trained to use</td>
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<tr>
<td></td>
<td></td>
<td>safety glasses with sideshields (ANSI Z87.1)</td>
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<td>shoes that cover the entire foot</td>
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<td></td>
<td></td>
<td>sturdy work gloves when handling rough or sharp material</td>
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<table>
<thead>
<tr>
<th>Locations</th>
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<tbody>
<tr>
<td>Building</td>
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<tr>
<td>----------</td>
</tr>
<tr>
<td>400</td>
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<tr>
<td>Type</td>
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<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>Draft</td>
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<tr>
<td>Review Team Lead Signoff</td>
</tr>
<tr>
<td>SME Review: Electrical hazards</td>
</tr>
<tr>
<td>ESH Coordinator Review</td>
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<tr>
<td>Divisional Approval</td>
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PRE/POST-JOB BRIEFING

- Required to be performed prior to the start of work, renew annually
- Utilize the APS Pre-job Briefing Form

APS Pre-job Briefing Form

Division: XSD
Group: MM
Pre Job Brief Title: Thomson Rail Stage Baseplate Modification and Assembly
Job Location: 61D
APS Work Request Ticket
Number:
Job Description: Use mill to drill 5 mm diameter holes located in existing Thomson rail base plate
per design.
Review of
procedures/guidance: Global WPC for APS beamlines 19202.4, LMS-PROC-153
Hazard level: Low
Is a CCWP required?: No (Check only if a Configuration Control Work Permit is required)
Hazard or potential hazards: Potential hand/eye injury
Ways to mitigate hazards: Wear PPE: Safety glasses, and gloves.
Authorizer: MCDOWELL, MICHAEL W.
Understanding your role: Yes
Does the assignee
understand Stop Work Authority? Yes 📌
Assignee: Douglas Robinson
Date: Mon Feb 26 2018 16:12:48 GMT-0600 (Central Daylight Time)

• Post Job when completed to provide Feedback and Improvement
RECENT LABORATORY MANDATE TO CAPTURE HIGH RISK WORK

- DOE heightened scrutiny of ANL safety

- Purpose is to keep all appraised of high risk, high rigor, unique or one-off work activities planned, methods to mitigate risk, and status of ongoing activities.

- Required for WCD rigor of High

- In PSC, high risk work has to be approved by the division director, for CATs this approver is George Srajer
REPORTING HIGH HAZARD WORK

- Mandated Laboratory reporting tool is a Vector Application
- Starts June 4
- Allows for Dashboard and Calendar functions
IMPLEMENTATION SCHEDULE

- Complete WCD for all SOP’s listed in Sector Safety Plan
- Implementation target date: August 1, 2018
SUMMARY

- Implementation of Working Planning and Control for CATs should be straightforward
- Many activities beyond ESAFs and Construction have been already captured
- PSC is committed to working with CAT to smoothly, and, hopefully painlessly implement the WP&C process
QUESTIONS?
ADDITIONAL SLIDES

WORK PLANNING AND CONTROL – RISK ASSESSMENT AND GUIDE TO DISCUSSIONS
RISK SCREENING CRITERIA

Chemical/Laboratory
- Work with toxic gases such as metal hydrides or corrosives
- Handling of pyrophoric materials with particle size small enough to support spontaneous combustion
- Working with highly corrosive or toxic chemicals/acids
- Use of primary explosive material and/or use of low energy electro-explosive devices
- Entry into environments with potential imminent danger to life or health, including work that may activate chemical deluge systems
- Operating, aligning, or servicing openly accessible or exposed Class 3B or Class 4 laser beams
- Work in very high radiation areas

Field Work
- Working at heights requiring a fall protection plan
- Hoisting and rigging work that requires a critical lift plan
- Confined space entry
- Excavation of wall, floor, or ceiling penetration where you cannot identify all potential hidden hazards
- Excavation with power equipment to a depth of eight inches or more that might contact underground utilities or when an employee must enter an excavation five feet or more in depth

Electrical/Pressure
- Energized electrical work > 50 V
- Work on equipment or processes involving multiple types of hazardous energy sources requiring LOTO
- Work with high pressure systems
- Work within < 10 ft of an overhead power line > 50 kV, including equipment movement underneath
- Work with or around high voltage equipment (>480 volts)

Security and Sensitive Information
- Work with classified documents
- Work with ITAR or other sensitive, but non-classified information
- Handling of Personally Identifiable Information (PII)
OVERLAY CONSIDERATIONS

**Work Schedule**
- First time work
- Work that has not been performed for an extended period of time
- Work scheduled on weekends or on overtime
- Working under highly aggressive schedule pressures

**Personnel**
- Work involving coordination between multiple work groups
- Subcontractor work on hazardous equipment or systems
- Work done by staff, post-docs, users, and students that are new to the lab

**Supervision**
- Work overseen by a new supervisor
- Work done in areas where there is not bandwidth for significant management oversight

**Group or Individual Dynamics**
- Work done by groups or individuals experiencing unusually high levels of stress
- Work done by groups that are having unusual management/employee interaction issues (e.g. harassment complaints, grievances)
- Work done by an employee or group that have shown past risky behaviors or tendencies to cut corners

**Work Environment**
- Work in high heat or low cold environments
- Work in off-site or remote field locations
- Work with equipment that has come to the Lab outside of normal procurement avenues (e.g. as excess or on loan from another lab or university)
DEFINITIONS

- Risk - the chance or probability that a person will be harmed or experience an adverse health effect if exposed to a hazard. It may also apply to situations with property or equipment loss, or harmful effects on the environment.

- Hazard - A source of danger (i.e., material, energy source, or operation) with the potential to cause illness, injury, or death to personnel or damage to a facility or to the environment (without regard to the likelihood or credibility of accident scenarios or consequence mitigation).

- Rigor - The formality of work control, including documentation and execution, based on the complexity of the work and the related safety consequences.
LABORATORY REQUIREMENT ON REPORTING HIGH RISK WORK (NON-ESAF)

- Weekly ALD review of high risk / high hazard planned work
  - Screening criteria used as shown in addition to other criteria (WCD rigor of Medium or High, SME review invoked, etc.)
  - Purpose is to keep all appraised of high risk, high rigor, unique or one-off work activities planned, methods to mitigate risk, and status of ongoing activities.

- Currently utilizing home-grown electronic **APS Moderate and High Risk Work Register**

- In PSC, high risk work has to be approved by the division director, for CATs by George Srajer