



# Efficient Safe-Work Planning in Accelerator Maintenance Activities

AMMW 2015

Stephen Smith, CSSBB

Jefferson Lab

# Agenda

Objective: Explain how efficient safe-work-planning can avoid or minimize Maintenance delays. Show relevant examples.

## Agenda:

- How can a safe-work process avoid delays?
- What are the basic functions of a Safe Work process?
- What support elements can minimize delays?
- How should the overall System be set up?
- Summary

# How a Safe-Work Process can avoid delays

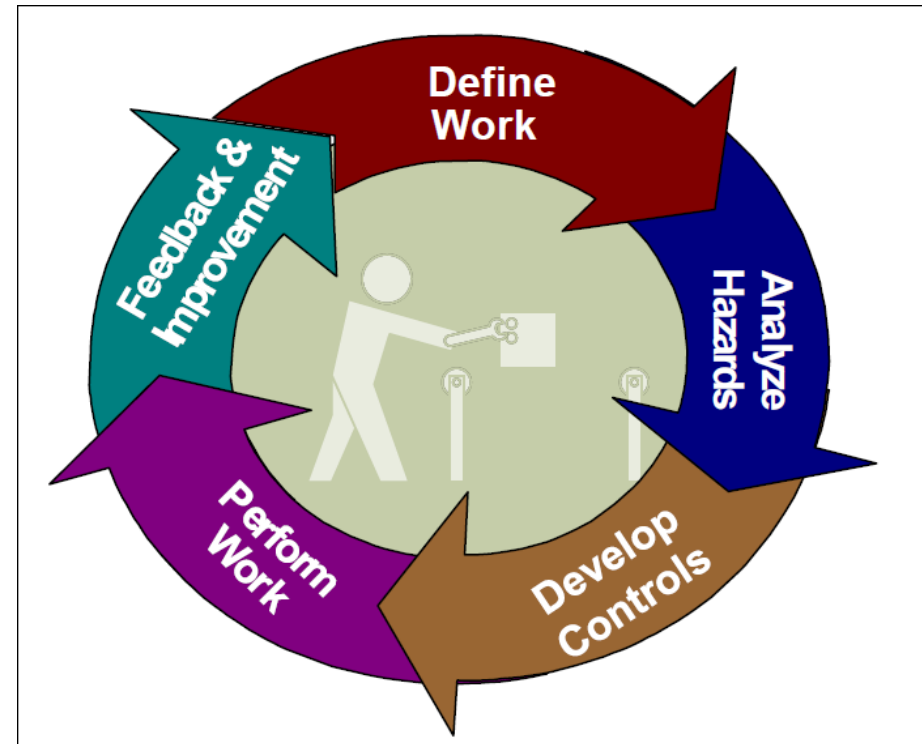
- Maintenance Safety delays are caused by issues that are either:
  - Not known
  - Known but not anticipated to impact
- A properly setup and supported Safe-Work Process should prevent or greatly reduce both types of occurrences

Exposed, energized cables. This caused a protracted work delay in an experimental Hall.



# Basic Functions of a Safe-Work Process

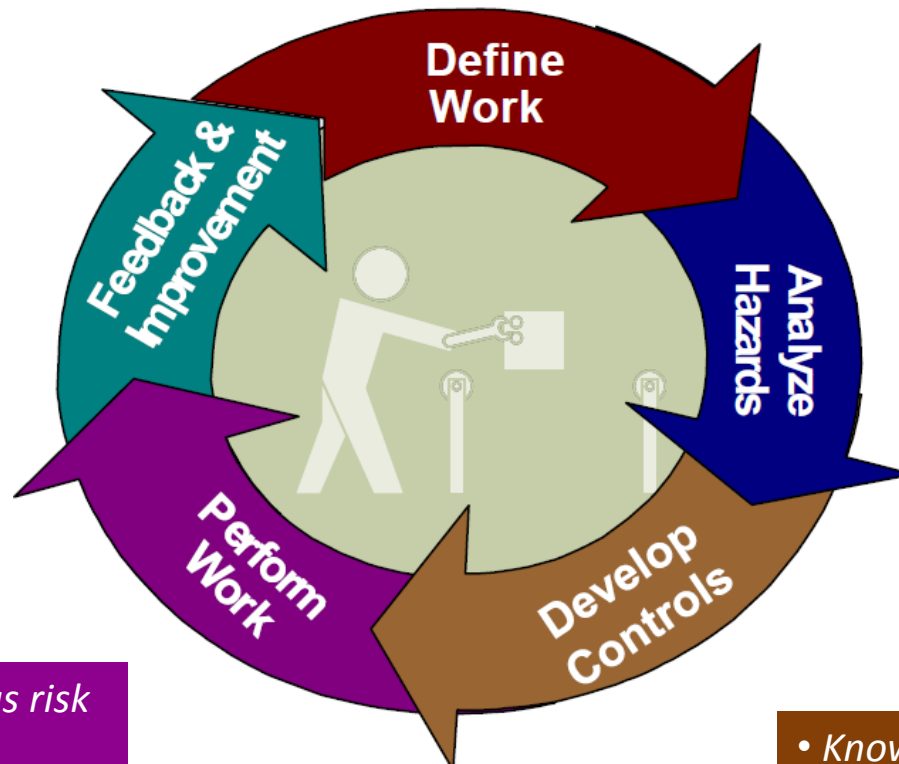
- Define Work Scope
- Identify the Safety Hazards
  - Prioritize Safety Hazards
    - Plan to avoid or substantially mitigate
    - Set acceptable risk thresholds
- Finalize the plan; develop the Controls
- Perform the Work within Controls
- Provide feedback and improve the next time.



# Support Elements which Minimize Delays

- *Automated, concise notification of workers and Safety advisors*

- *Increased participation as risk increases*



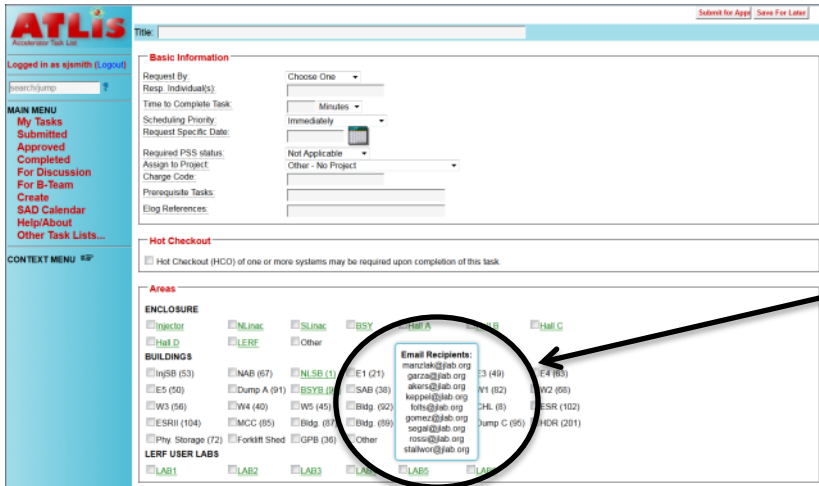
- *System to determine risk*
- *System of known risk thresholds*
- *Scaled planning and approval process as risk increases*
- *Easily obtainable Equipment Configuration scenarios*

- *More segmentation as risk increases*
- *Equipment Configuration Assurance*
- *Back-out and Restart plans*

- *Known and available Safety mitigations (engineered controls, PPE)*
- *More communication / input as risk increases*

# Setting Up the Process and Tools, 1 of 4

- The Process provides guidelines and thresholds for risk
  - The tools implement the process



Task List (different from a Log)

Concise notifications; texts for higher risk, more urgent activities

System for determining and prioritizing risk

Table 1: **Consequence Levels**

Consequence Level	Severity	Property Loss
<b>High (H)</b>	Serious impact on-site. May cause death or loss of facility operation. Major impact on the environment.	> \$100,000
<b>Medium (M)</b>	Significant impact on-site. May cause severe injury, severe occupational illness to personnel, major damage to the facility operation, or impact on the environment.	> \$50,000
<b>Low (L)</b>	Minor impact on-site. May cause minor injury, minor occupational illness, or minor impact on the environment.	> \$500
<b>Extremely Low (EL)</b>	Insignificant injury, occupational illness, or impact on the environment.	< \$500

Table 2: **Probability of Incident**

Probability Level	Description*
<b>High (H)</b>	An incident is likely to occur several times in a year.
<b>Medium (M)</b>	An incident is likely to occur annually.
<b>Low (L)</b>	An incident is likely to occur during the life of the facility or operation.
<b>Extremely Low (EL)</b>	Occurrence is unlikely or the incident is not expected to occur during the life of the facility or operation.

# Setting Up the Process and Tools, 2 of 4

## EH&S Hazard Identification Worksheet

Instructions: Answer the following questions from Appendix 3210-T2 of the EH&S Handbook. Questions with answers that indicate a hazard may exist should be discussed with your supervisor/manager/EH&S staff. Resolutions and hazard mitigations must be noted in the block provided. Please see [EH&S manual Section 3210](#) for further reference. This worksheet is intended as just a starting point. Having identified the hazards associated with this task, next review the associated guidance in the EH&S Manual and develop procedures and controls tailored to the work.

### General EHS&Q Hazards

YES NO

- |                       |                       |  |
|-----------------------|-----------------------|--|
| <input type="radio"/> | <input type="radio"/> | Do you require familiarization with the work area and its current state? Do you need to perform a pre-job walkdown? ( 3210 ) |
| <input type="radio"/> | <input type="radio"/> | Are there <a href="#">MSDS</a> requirements for the materials being used with which you are unfamiliar? ( 6610 T1 )          |
| <input type="radio"/> | <input type="radio"/> | Will you be working with or mixing <b>chemicals</b> ( 6610 )   |

- System of known risk thresholds
- Known and available Safety mitigations

Chemicals

- Training
- PPE

**Question:** What PPE is required for working with liquid/powder chemicals? [E-mail link](#)

**Answer:**  
Determined by the hazard, but you probably need something from each category:


- Body Protection
- Eye and Face Protection
- Hand (Gloves) Protection

---

- Signage
- Work Safely Procedures
- Work Control Documents
- Procurement
- Storage
- Disposal, Clean-up, Recycle
- Transport
- Requirements
- Material Safety Data Sheets (MSDS)
- Subject Matter Expert (SME)
- Lessons Learned



# Setting Up the Process and Tools, 3 of 4

 <b>Operational Safety Procedure Review and Approval Form # 29462</b> <small>(See ES&amp;H Manual Chapter 3310 Appendix T1 Operational Safety Procedure (OSP) and Temporary OSP Procedure for Instructions)</small>					
Type:	<b>OSP</b> Click for OSP/TOSP Procedure Form Click for LOSP Procedure Form				
Serial Number:	<b>ENG-13-29462-OSP</b>				
Issue Date:	<b>9/20/2013</b>				
Expiration Date:	<b>8/20/2016</b>				
Title:	<b>Testing and Adjusting Magnet Power Supplies while Energized</b>				
Location: (where work is being performed)	<table border="1"> <tr> <td> <b>West ARC Service (W2) - W202</b>  <b>North Access</b>  <b>South Access</b>  <b>Technology &amp; Engineering Development Floor 1</b>  <b>West ARC Service (W2)</b>  <b>South Extractor Service (W1)</b>  <b>North LINAC - NLZ6</b>  <b>South LINAC - SLZ1</b>  <b>General Purpose Building</b> </td> <td> <b>Location Detail:</b>  <small>(specifics about where in the selected location(s) the work is being performed)</small> </td> <td> <b>All Locations where DC Power Supplies are installed, EESDC Power Work Labs and Test Stands</b> </td> </tr> </table>	<b>West ARC Service (W2) - W202</b> <b>North Access</b> <b>South Access</b> <b>Technology &amp; Engineering Development Floor 1</b> <b>West ARC Service (W2)</b> <b>South Extractor Service (W1)</b> <b>North LINAC - NLZ6</b> <b>South LINAC - SLZ1</b> <b>General Purpose Building</b>	<b>Location Detail:</b> <small>(specifics about where in the selected location(s) the work is being performed)</small>	<b>All Locations where DC Power Supplies are installed, EESDC Power Work Labs and Test Stands</b>	
<b>West ARC Service (W2) - W202</b> <b>North Access</b> <b>South Access</b> <b>Technology &amp; Engineering Development Floor 1</b> <b>West ARC Service (W2)</b> <b>South Extractor Service (W1)</b> <b>North LINAC - NLZ6</b> <b>South LINAC - SLZ1</b> <b>General Purpose Building</b>	<b>Location Detail:</b> <small>(specifics about where in the selected location(s) the work is being performed)</small>	<b>All Locations where DC Power Supplies are installed, EESDC Power Work Labs and Test Stands</b>			
Risk Classification: <small>(See ES&amp;H Manual Chapter 3210 Appendix T3 Risk Code Assignment)</small>	<table border="1"> <tr> <td>Without mitigation measures (3 or 4):</td> <td><b>4</b></td> </tr> <tr> <td>With mitigation measures in place (N, 1, or 2):</td> <td><b>2</b></td> </tr> </table>	Without mitigation measures (3 or 4):	<b>4</b>	With mitigation measures in place (N, 1, or 2):	<b>2</b>
Without mitigation measures (3 or 4):	<b>4</b>				
With mitigation measures in place (N, 1, or 2):	<b>2</b>				

- More segmentation as risk increases
- Equipment Configuration input

Sequence of Task Steps	Task Steps/Potential Hazards	Consequence Level	Probability Level	Risk Code (before mitigation)	Proposed Mitigation (Required for Risk Code >2)	Safety Procedures/Practices/Controls/Training	Risk Code (after mitigation)
3	Energized Testing of the PS with doors open and interlocks bypassed with test equipment installed while power supply is Locked out and de-energized. Use of Hands-Off techniques. Class 3 shock hazard, Arc Flash hazard	Medium	Medium	4/3	Perform measurement equipment connection with PS de-energized and LT&T where necessary. Re-energize supply to make measurements. L&T the PS to remove or reposition test equipment. Barriers/shields installed as required.	Hands Off observation of instruments connected to PS only, PPE required to be inside Arc Flash and Limited Approach Boundaries. Only Authorized people may perform work under supervision of senior personnel, 2-man rule, safety watch requirements	1
4	Energized Testing of the PS with doors open and interlocks bypassed, with test equipment, performed using Hands-On probing. Class 3 shock hazard, Arc Flash Hazard	Medium	Medium	4/3	Hands-on probing to make measurements on only easily accessed measurement points using appropriately rated equipment and PPE. Barriers/Shields installed as required to prevent inadvertent contact with nearby circuitry.	Procedures and techniques described in the document. PPE required, authorized personnel only under direct supervision of senior personnel, 2-man rule, safety watch requirements, voltage rated test equipment or isolated test equipment used	2



# Setting Up the Process and Tools, 4 of 4

- Back out and Restart Plans

## 5. Back Out Procedure(s) i.e. steps necessary to restore the equipment/area to a safe level.

1. LT&T equipment according to equipment specific procedures
2. Remove all test equipment
3. Restore all circuits to their proper operational condition
4. Re-test interlocks
5. Get approval from Engineering/Operations if restoring power to the Accelerator
4. Restore operation of power supply

- Scaled planning and approvals

### Review Signatures

Person : Merz, Bill (merz) <b>Reasoning:</b> Electrical Safety	<b>Signed</b> on 9/19/2013 8:44:59 AM by Bill Merz (merz@jlab.org)
Person : Nelson, Rick (nelson) <b>Reasoning:</b> Shock Hazards	<b>Signed</b> on 9/19/2013 8:58:06 AM by Rick Nelson (nelson@jlab.org)
Subject Matter Expert : Electricity	<b>Signed</b> on 9/18/2013 4:05:05 PM by Todd Kujawa (kujawa@jlab.org)

### Approval Signatures

Division Safety Officer : EESDCP	<b>Signed</b> on 9/19/2013 1:37:36 PM by Henry Robertson (robertsn@jlab.org)
Org Manager : EESDCP	<b>Signed</b> on 9/19/2013 11:08:43 AM by Will Oren (oren@jlab.org)

# Summary

- Delays associated with Safe-Work Processes can be avoided or minimized
- Support Elements make Safe-Work Processes more efficient
  - Systems for identifying and prioritizing risks
  - Easily obtainable equipment lineups
  - Concise notification of workers and Safety advisors
    - Avoiding “death by email”
  - Back out and restart plans
  - Scaled planning and approvals
  - Post-job feedback for higher risk work