How to Operationalize a Pipeline Safety Management System

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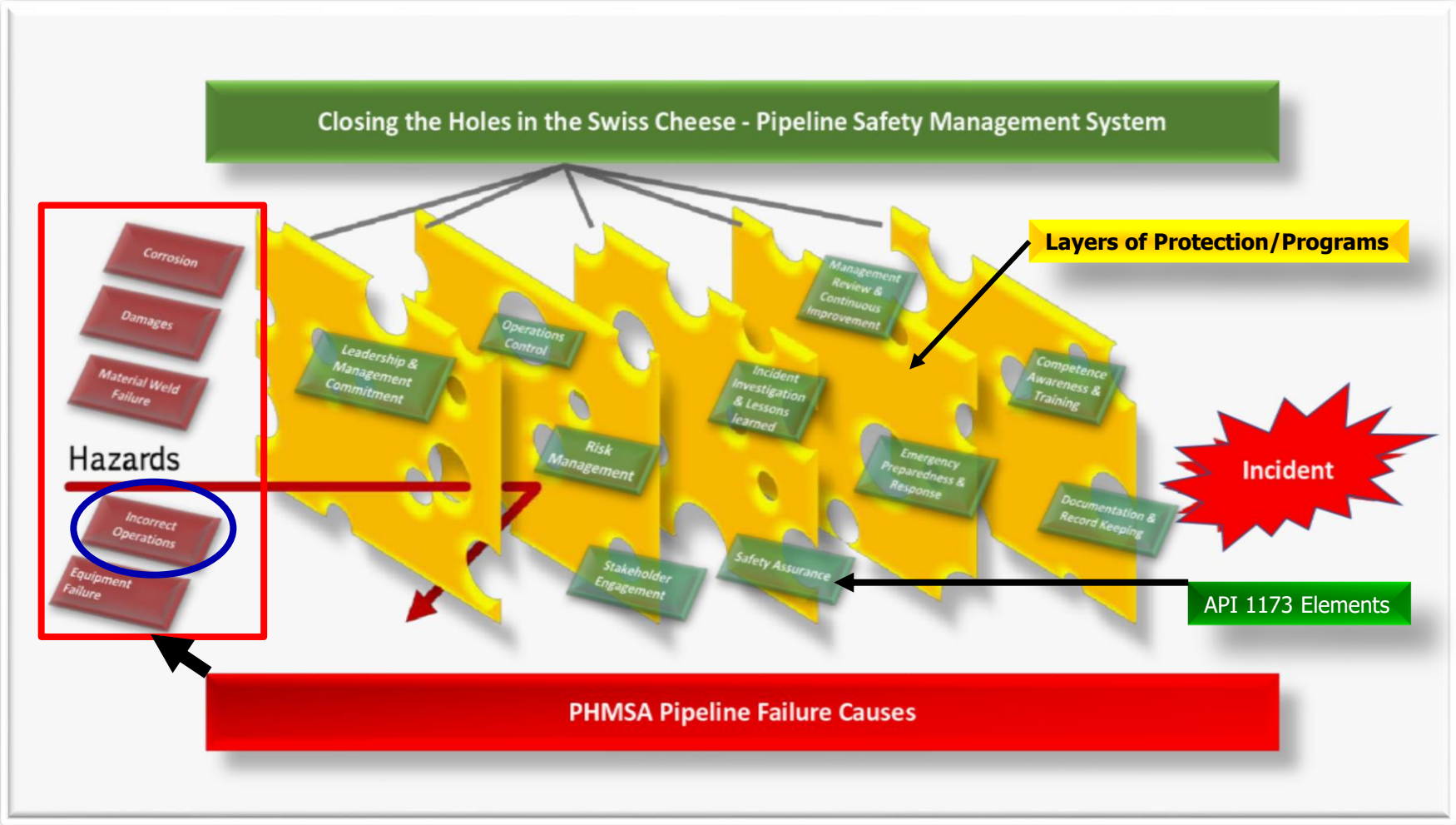
NGA 2019 Fall Conference
Mike Gallinaro

Agenda

- **Overview 1173**
  - What SMS is..
  - What SMS isn't..
- **What we are doing now**
  - The Implementation Plan
- **Tactical Field Guide**
  - Development
- **Questions**

What SMS is..


Closing the Holes in the Swiss Cheese - Pipeline Safety Management System
Layers of Protection/Programs
Corrosion
Damages
Material Weld Failure
Hazards
Incorrect Operations
Equipment Failure
Leadership & Management Commitment
Operations Control
Risk Management
Stakeholder Engagement
Incident Investigation & Lessons learned
Safety Assurance
Management Review & Continuous Improvement
Competence Awareness & Training
Emergency Preparedness & Response
Documentation & Record Keeping
Incident
API 1173 Elements
PHMSA Pipeline Failure Causes

What SMS isn't..

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"Not just another Book on the shelf"

- **PSMS incorporates *existing pipeline safety systems, programs & practices***

So what brought us here?

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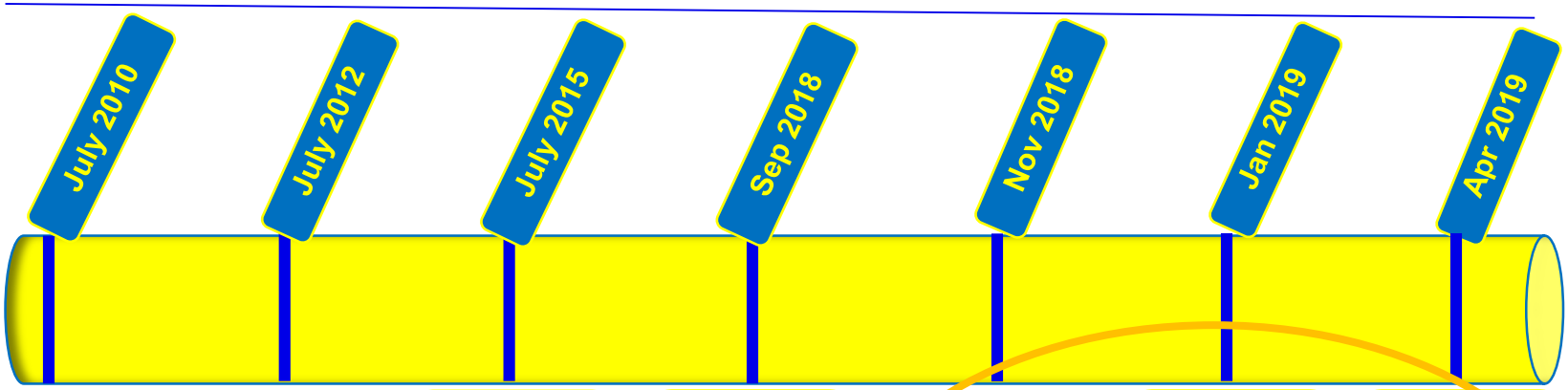

- A 30" pipeline ruptured in a wetland in Marshall, Michigan.
- The NTSB issued Safety Recommendation to API to develop a PSMS.
- API 1173 was released in response to major industry incidents.
- Merrimack Valley gas Incident.
- NGA issues an RFP for assistance with Implementing a PSMS for participating LDC's.
- The Blacksmith Group LLC offers the proposal to assist NGA with its request.
- NGA sponsored a Pipeline Safety Management System (PSMS) Working Group Kick-off Meeting.

We are moving forward with implementing PSMS..

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List of Participating Organizations
National Grid
Con Edison
PSE&G
Columbia Gas (MA)
Eversource Energy
UGI
O&R
Liberty Utilities
Unitil
Vermont Gas Systems
Berkshire Gas
Holyoke Gas & Electric
Middleborough Gas & Electric
Wakefield Gas & Electric
Westfield Gas & Electric
Blackstone Gas

The Implementation Plan

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PSMS Implementation Initiative

Task 1	Task 2	Task 3	Task 4	Task 5
Half-Day Meeting at Corporate Headquarters (Starting with Massachusetts operators) Discussion with Top Management Review of work done to conform with RP 1173 Key First Steps Blacksmith Perspectives on RP 1173 Preparation for Gap Analysis Deliverable – Leading Practices and Key Shares Initial meeting with each applicable state Commission • **Deliverable – Leading Practices and Key Shares**	Review the gap analysis with organization leads at a high level - Process used - Personnel involved – breadth and depth Conduct deeper review of selected elements - Leadership and management commitment - Risk management - Operational controls - Safety assurance - Management reviews and continuous improvement - Member selected elements Assess level of maturity Deliverable: Report on Completed Gap Analysis and Opportunities for Improvement and Maturity Assessment	Work with each member to develop/ review a road map to address gaps and any resulting compliance issues that may surface Produce a draft for member review based on risk ranking of gaps and/or compliance related issues discovered as a result of gap analysis Review road map with top management and personnel in functional areas to define gap closure • **Road Map to close gaps**	Develop key considerations for design & construction of maintenance and new mains & services installations Assemble a cross functional team with: - supervisors, foreman, - technicians, contractors, - engineering personnel who routinely develop mains & distribution designs (including work packages), - Operations Enable personnel at all levels to help identify risk and actively seek their input on mitigation Discuss lessons learned & mature to a documented process Reinforce non-punitive reporting Enable Managers and Supervisors to spend time reinforcing Develop "Tactical Guidelines" for Managers and Supervisors	**Performance Benchmarking and Information Sharing** Structured Process ✓ Provide objective evidence of progress towards achieving desired results ✓ Inform better decision making ✓ Offer a comparison that gauges the degree of performance change over time ✓ Track effectiveness, quality, compliance, behaviors, resource utilization and use of tools among others • Balanced between leading and lagging indicators ✓ Process and Stewardship measures ✓ Outcome measures **Work Products – Initial set of metrics – Stewardship, Leading and Lagging; Information Sharing System**

So, what functions will have Guides?

1. **Pressure Regulation & Control**
2. **Mains & Services Construction**
3. **Gas Control**
4. Distribution System Maintenance
5. Damage Prevention
6. Engineering Design & Integrity Management
7. Pipeline Safety Public Awareness
8. LNG Operations

So, what's in the Tactical Field Guides?

- General Overview
- Guiding Principles for our Field Forces
- How we tie together PSMS Elements, PDCA, guiding principles & 'High Risk' Activities
- Activity Description and Tactical Guides for 5 High Risk Activities
- PSMS Critical tools
  - ✓ Pre-job Briefs (PJB)
  - ✓ Post Job Review/Assessment (PJR)
  - ✓ Pre-Start Up Safety Review (PSSR)
  - ✓ Management of Change (MOC)

Example of Introduction General Overview

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One of the greatest challenges with implementing any safety management system is transforming strategy into meaningful engagement experiences for technicians involved in day-to-day activities. These technicians are on the *front line* of pipeline safety opportunities; with every decision they make and every action they take. Operationalization of safety management system strategy is key to facilitating the transformation of day-to-day behaviors and ultimately long-term safety culture. We need to encourage pipeline safety operational ownership by demonstrating *how* PSMS can be used as an effective tool to maximize system safety and reliability. We do this through connecting routine work activities with a Plan-Do-Check-Act (PDCA) approach that guides our decisions and actions.

This Guide includes the following high-risk activities:

- ✓ Regulator Station Performance Testing & Inspection
- ✓ Critical Valve Testing & Inspection
- ✓ Overpressure Protection
- ✓ Instrument Inspection, Verification & Calibration
- ✓ Odorization

The goal is to provide a simplified pipeline operators' view of how PSMS is connected to day-to-day operational activities that occur within a specific functional area with a strong focus on Management of Change (MOC) and Abnormal Operating Conditions (AOC's).

Example of Guiding Principles

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- ✓ Walk the job down
- ✓ Always consider what could go wrong *"What if.. & What is my plan"*
- ✓ *Perform Pre-Job Briefs (PJB)*
- ✓ *Perform Pre-Startup Safety Reviews(PSSR), when necessary*
- ✓ *Management of Change (MOC) - Identifying, Reporting & Documenting Field Changes*
- ✓ *Refer to Job Specific / Procedure Specific Potential AOC's & Reactions*
- ✓ *Always Use Approved Materials & Equipment*
- ✓ *Avoiding "Work Arounds"*
- ✓ Communicate Throughout the job, *trust but verify*
- ✓ Understand What, Why & How
- ✓ When Responding to Emergencies Always be Prepared & Document Changes
- ✓ Learn from Past & Present Events & discuss during PJB & feedback during Post Job Reviews (PJR)
- ✓ "See Something, Say Something, Do Something"
- ✓ Always look to improve ways to keep our People, Public and Pipelines safe

Example - Pressure Regulation & Control

How it all fits together

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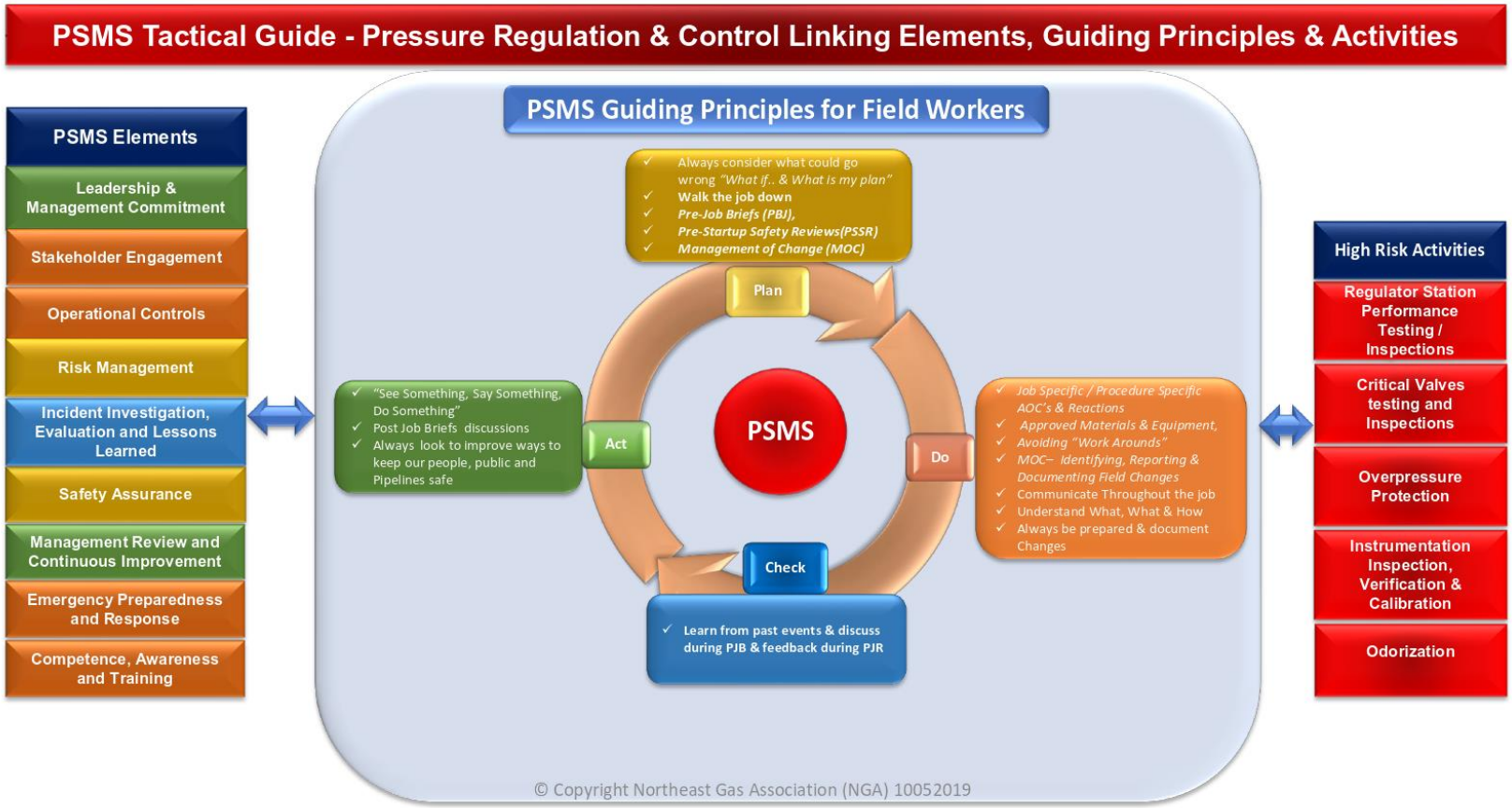

Example –Critical Valve Testing & Inspection

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Pressure Regulation & Control – Critical Valve Inspections, Testing & Maintenance

Valve testing and inspections are required to ensure on-going proper operation of critical valves when needed. Minimum Federal Safety Standards are identified in 49 CFR 192.747 and include the following: valve maintenance and testing is required for those valves that may be necessary for safe operation of a sectionalized distribution system (aka critical valves). The valve(s) must be inspected, checked (tested) and serviced at intervals not exceeding 15 months, but at least once each calendar year and/or in accordance with company specific procedures.

Scope of inspection (minimum requirements):

- Valves should be correctly located and identified
- The valve box cover should be accessible, and the valve box cleaned out
- The valve should be operable as defined by your company specific procedure
- Gauge lines, if present, should be clear of obstructions and operable
- Lubrication should be conducted per company specific procedures

Record of inspection

The inspection and findings should be documented in accordance with company specific procedures including the date, time and name of technician performing the inspection.

Maintaining integrity of the sectionalized system

All proposed new main extensions or main replacements should be reviewed to determine if a sectionalizing valve (critical valve) is affected and/or a new one should be installed to maintain or improve the integrity of the sectionalized system. The sectionalizing plan should also be reviewed in accordance with company specific procedures.

Valve Verification

All newly installed critical valves should be field tested. The test should include checking for correct identification, location measurements/correct identification/location in company mapping system, physical condition, and proper operation. The assigned identification (i.e. valve tag or stamp) should be installed and recorded in the company mapping system as soon as possible.

Sectionalizing Maps

A sectionalizing map showing valve locations should be maintained for each town, district, or section of the distribution system.

Benefits of a Sectionalizing (Critical Valve) Program

In addition to the benefits of being able to rapidly reduce pressure or completely shut down a specific area in the event of an emergency, additional operational benefits of the ability to sectionalize a distribution system include systematic pressure reduction or isolation of systems for purposes of uprating. For example, whenever planned operations require a reduction of pressure to facilitate making connections or performing maintenance work, the sectionalizing program shut-down procedure may be applied to the area involved. When it is necessary to increase the maximum allowable operating pressure (MAOP) of a distribution system, use of information obtained from a valve sectionalizing program may greatly simplify the implementation of the uprating by enabling isolation of defined sections of the system.

Note: Gas Control Should be aware of all work regarding valve operations.

Example – Tactical Field Guide for Critical Valve Testing and Inspection

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Pressure Regulation & Control – Critical Valves Testing and Inspections

PLAN

- Have you reviewed appropriate O&M Procedures?
- Is there a job specific procedure or work plan available & did you review it? (PJB)
- Does the procedure have enough detail relevant to the type of valve, including operating and testing requirements such as "normally open/normally closed positioning"?
- Are work clearances / permission to work including task sequencing specifically defined in the procedure?
- Do you have all the tools, equipment, parts needed?
- Do you have proper training & qualifications to perform work?
- Have you considered potentially impacted customers up and down stream of the valve operation, and communicated as necessary?
- Did you understand potential activity specific AOCs & required action?
- Have you considered Environmental Health & Safety (EHS) protocols during equipment maintenance procedure? (release or exposure to pipeline containments)
- Do you & your team know that you have the ability to stop work at for an unsafe or unknown condition?

DO

- Did you check the location of the valve and proper valve identification ?
- *Did you obtain permission to work?*
- *Was the valve properly lubricated (if necessary prior to operation)?*
- Are you monitoring system pressures locally in accordance with procedures and clearance to work.
- Are you communicating status of work to Gas Control as required?
- Did you communicate any changes in valve positioning and operation relative to what is in the operating procedure and were these changes documented (MOC)?
- Have valve(s) been returned to normal operating position and confirmed with Gas Control ?
- Did you document operation in accordance with company specific requirements including the date and time of operation and technician performing work ?
- Is any follow-up work required ?

CHECK

- Was a post job assessment performed?
- Did you verify valve identification prior to operation?
- Did you verify normal operation and valve position prior to start of work (normally open / closed) ?
- Did you verified that all valves been returned to normal operating positions and communicated to Gas Control ?
- Did any AOCs occur?
- Did procedure work-arounds occur & if so, were clearances obtained & were they documented?(MOC)

ACT

- Did you communicate lessons learned?
- If an unknown and/or unsafe condition occurred did you STOP WORK?
- If an AOC occurred, what mitigation measures did you take and did you document them?
- If a procedure work-around was found necessary, did you identify the reason and notify your supervisor prior to implementing /documenting changes?
- Did I review my record keeping documents prior to completing the job?

Pressure Regulation & Control – Critical Valves testing and Inspections

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Pressure Regulation & Control – Critical Valves testing and Inspections

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Pressure Regulation & Control – Critical Valves testing and Inspections

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Pressure Regulation & Control – Critical Valves testing and Inspections

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Pre-Job Brief (PJB) - Example of Topics & Question

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The purpose of the pre-Job briefing (PBJ) is to ensure that the Supervisor and workers understand and discuss the tasks that are going to be performed.

Example of some topics/questions that could be discussed during a PJB:

- Have you discussed the scope of work, critical steps and objectives to be performed?
- Have you discussed how a mistake might be made at a critical step?
- Have Individual job assignments been discussed?
- Have you discussed, and identified, any special tools, equipment and materials necessary for the job?
- Have you determined the initial conditions prior to performing work? (What needs to be in place before job starts)
- Have you determined final conditions? (The desired end result of the job)
- Have you discussed what is the worst thing that can go wrong and mitigations?
- Were there any previous Lessons Learned applicable to the current work project?
- Did you discuss any potential abnormal operating conditions (AOC) and actions to be taken?
- Are there any stop points/inspection points that have be communicated for the specific project?
- Are all proper work documents available & understood (procedures, standards,field sketches, etc.)?
- Have you discussed all hazards associated with the work & controls, PPE for those hazards?
- Have you discussed all potential precautions and limitations?
- Have you reviewed the contents of any required permits & are they posted and visible at job site, if applicable?
- Has the ability “Stop work” by anyone working the job been reinforced?
- Have you discussed regulatory compliance expectations?
- Have you discussed and hazardous energy source controls, if applicable
    - Installation of lock out/tag out
    - Work steps that sequence with lockout/tagout installation/removal
    - Safe-to-Work checks
- Were emergency response actions discussed?
- Question & concerns?

Post-Job Review (PJR) - Example of Topics & Question

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The Supervisors and crews can review the "good", "bad" and "ugly" experienced during work performed. The Post-Job Reviews / Assessments (PJB) can serve as a fundamental "layer of protection" toward personal, public and pipeline & asset safety.

Examples of topics/questions that could be include in a PJR.:

- Has work packages, field sketches, activities and job specific procedures been reviewed to verify that the all tasks have been completed.
- Were there any Abnormal Operating Conditions (AOC), good catches, problems, inefficiencies, coordination issues? If so, how were these dealt with?
- If an AOC occurred was it anticipated during the PJB?
- Were all issues identified and addressed?
- Were there lessons learned identified during the activity that could be improve personal, public and pipeline safety?
- Were there lessons learned identified during the activity that could be improve effectiveness and/or efficiency.
- Were all documents available and provided and updated as required (field sketches/drawings, permits, etc.)
- Was the Scope of work clearly defined, hazards identified, adequate controls, responsibilities understood?
- What did we do ***right*** that should be communicated in the next work control document and executed in the next activity?
- What could have been done differently on a similar job next time, if anything?
- Did our planning and job hazard assessments help us avoid problems?
- Did we accomplish our expected goals?

Management of Change (MOC)

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Operational failures resulting from insufficiently planned changes to technical, physical, procedural, and organizational activities can cause catastrophic events. MOC can be very effective in the prevention of accidents and can be used as a best practice at worksites.

MOCs:

- Identify the hazards associated with “change”
- Assess the risks associated with “change”
- Consider of OH&S hazards and risks *prior to* the introduction of the “change”
- Implement controls needed to address the hazards and risks associated with the “change”
- Ensure that changes to a process do not inadvertently introduce new hazards or unknowingly increase risk of existing hazards.
- Include a review and authorization process for evaluating proposed adjustments to an asset design, operations, organization, procedures or activities prior to implementation to make certain that no unforeseen new hazards are introduced and that the risk of existing hazards to employees, the public, or the environment is not unknowingly increased
- Include steps to help ensure that potentially affected personnel are notified of the change and that pertinent documents, such as procedures, process safety knowledge, and so forth, are kept up–to-date.
- Minimize unplanned adverse impacts on system integrity, security, stability, and reliability.
- Maximize the productivity and efficiency of staff planning, coordinating, and implementing the changes.
- Ensure the proper level of technical completeness, accuracy of modifications, and testing of systems before implementation.

A few examples of changes a business may wish to manage are:

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- **"Not in Kind" replacement of process equipment or parts**
- Modifications or minor additions to process equipment, to critical business system (procedural or software), & infrastructure / non-process equipment
- **Changes to process control and/or instrumentation**
- Changes in specifications or sourcing of technical MRO
- Changes in critical process parameter operating limits (outside of ranges specified in SOP)
- Alterations to safety systems (interlocks, shutdowns, fire or explosion suppression, etc.)
- Revisions to standard operating procedures (including emergency procedures)
- Changes in site-level organizational structure
- **Changes to maintenance procedures**
- Changes in raw material / component specifications or sourcing
- Alterations or new connections to utilities systems (air, electrical, gas, water, steam, etc.).
- Alterations or new connections to critical data networks
- Changes to QA procedures or critical test equipment

Pre-Startup Safety Review (PSSR)

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The PSSR:

- Is a critical element of all Process and Pipeline Safety Management programs and is completed prior to starting up a new or modified process and/or asset
- Helps to ensure the new or modified process and/or asset is safe and operable before startup. PSSR should also be utilized to assets that have been out of service for an extended period as a result of repair or temporary discontinuation of use
- Represents field verification that the change was conducted the way it was designed and approved through the Management of Change (MOC) Element

Conducting the (PSSR)

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Before starting or restarting the operation is important to ensure:

- The as-built condition is the same as the design.
- installations meet the original design and operating
- Safety, operating, maintenance & emergency procedures are in place and adequate
- Appropriate safety and hazard reviews during engineering phase have been carried out and all action items have been completed
- Any site modifications during construction phase have been properly controlled & noted
- In addition to verifying that all associated equipment is functional and operating properly, a PSSR also verifies all affected employees have been properly and thoroughly trained and that all process documentation and procedures

Following are some good practices can help ensure a PSSR is performed properly:

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- Assign a PSSR Business Leader to oversee the PSSR team.

- The PSSR Business leader should assemble an appropriate multi-disciplined team of personnel to include and at a minimum: Engineering, Maintenance, Instrument and Controls, Project Management, Operations and Safety to complete the PSSR and the additional follow-up activities.

- The team should use a checklist or other suitable PSSR form to verify all required parts of the PSSR are completed.
- Ensure the team understands all the assets, equipment and associated instrumentation and controls subject to the PSSR.

- If necessary, consider using third-party contractors and consultants to supply necessary information or technical expertise on the equipment or process under review.

Incidents are usually a result of multiple layers of protection all failing at once

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"Seldom does a single problem alone lead to industrial disaster. More often, calamitous failure results from a combination of minor problems, errors and flawed operating habits which have developed gradually over time.

No one component problem seems to be significant , yet when all components merge . Disaster results"

- ***The Industrial Operator's Handbook – HC Howlett***