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Best Practice:
The intersection of HPI and Work Planning and Control

ISM-HPI-22-01
ISM-WP&C-22-01

Task Description

The EFCOG Human Performance Improvement (HPI) Task Team (TT) and the Work Planning & Control (WP&C) TT collaborated to develop a Best Practice that provides examples of how to integrate of HPI into WP&C tasks.

This document is a collection of some best practices as determined by team members.

This best practice will:

- Document the integration of HPI into WP&C
- Provide some best practices and techniques for various HPI tools and human factored writing techniques
- Generation of guidance for improvement on Pre-Job Briefs, Post Job Reviews, Integrating HPI into job planning. Pause/stop work, etc.
- Align ISM wheel with HPI tools
- Emphasize the importance (value added) when HPI is part of WP&C; building resiliency into the process

Best Practices

This best practice is binned into three major areas; Select the hyperlink below to go to that section.

1. Content from Department of Energy and EFCOG documents
    - DOE-HDBK-1211-2014, Activity-Level Work Planning and Control Implementation
    - DOE-HDBK-1028-2009, Volume 1, Human Performance Principles and Concepts, Integration of ISM and HPI Table
    - EFCOG Work Planning and Control Task Team developed a "Guideline Document" (April 12, 2012), Appendix C. HPI and QA
2. ISMS and HPI integration illustrations
    - Illustration 1: LANL "ISM and HPI Tools"
    - Illustration 2: SRS "Disciplined Conduct of Operations: Integrated Work Management - Human Performance Work Flow"
    - Illustration 3: SRS "Workflow from Task Readiness through Post-Job Review"
    - Illustration 4: LLNL "The WPC Process"
3. Selected topics
    - Critical Steps
    - Taking the human into account
    - Selecting the right HPI tool for the situation
    - Pre-Job Brief
    - A Learning Organization
    - Work Implementation – The Human Element

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Content from Department of Energy and EFCOG documents

DOE-HDBK-1211-2014, Activity-Level Work Planning and Control Implementation states:

- Human Performance Improvement (HPI): A set of concepts and principles associated with a performance model that illustrates the organizational context of human performance. The model contends that human performance is a system that comprises a network of elements that work together to produce repeatable outcomes. The system encompasses organizational factors, jobsite conditions, individual behavior, and results (DOE-HDBK-1028-2009).
- Work Planners (Preparers) - Takes Human Performance Improvement (HPI) factors into consideration.

DOE-HDBK-1028-2009, Human Performance Improvement Handbook, Volume 1: Concepts and Principles contains a section on Integrated Safety Management and HPI. It states:

INTEGRATED SAFETY MANAGEMENT AND HPI

DOE developed and began implementation of Integrated Safety Management (ISM) in 1996. Since that time, the Department has gained significant experience with its implementation. This experience has shown that the basic framework and substance of the Department's ISM program remains valid. The experience also shows that substantial variances exist across the complex regarding familiarity with ISM, commitment to implementation, and implementation effectiveness. The experience further shows that more clarity of DOE's role in effective ISM implementation is needed. Contractors and DOE alike have reported that clearer expectations and additional guidance on annual ISM maintenance and continuous improvement processes are needed.

Since 1996, external organizations that are also performing high-hazard work, such as commercial nuclear organizations, Navy nuclear organizations, National Aeronautics and Space Administration, and others, have also gained significant experience and insight relevant to safety management. The ISM core function of "feedback and improvement" calls for DOE to learn from available feedback and make changes to improve. This concept applies to the ISM program itself. Lessons learned from both internal and external operating experience are reflected in the ISM Manual to update the ISM program. The ISM Manual should be viewed as a natural evolution of the ISM program, using feedback for improvement of the ISM program itself. Two significant sources of external lessons learned have contributed to that Manual: (1) the research and conclusions related to high-reliability organizations (HRO) and (2) the research and conclusions related to the human performance improvement (HPI) initiatives in the commercial nuclear industry, the U.S. Navy, and other organizations. HRO and HPI tenets are very complementary with ISM and serve to extend and clarify the program's principles and methods.[3] As part of the ISM revitalization effort, the Department wants to address known opportunities for improvement based on DOE experience and integrate the lessons learned from HRO organizations and HPI implementation into the Department's existing ISM infrastructure. The Department wants to integrate the ISM core functions, ISM principles, HRO principles, HPI principles and methods, lessons learned, and internal and external best safety practices into a proactive safety culture where:

- facility operations are recognized for their excellence and high-reliability;
- everyone accepts responsibility for their own safety and the safety of others;
- organization systems and processes provide mechanisms to identify systematic weaknesses and assure adequate controls; and
- continuous learning and improvement are expected and consistently achieved.

The revitalized ISM system is expected to define and drive desired safety behaviors in order to help DOE and its contractors create world-class safety performance.

In using the tools, processes, and approaches described in this HPI handbook, it is important to implement them within an ISM framework, not as stand-alone programs outside of the ISM framework. These tools cannot compete with ISM, but must support ISM. To the extent that these tools help to clarify and improve implementation of the ISM system, the use of these tools is strongly encouraged. The relationship between these tools and the ISM principles and functions needs to be clearly understood and articulated in ISM system descriptions if these tools impact on ISM implementation. It is also critical that the vocabulary and terminology used to apply these tools be aligned with that of ISM. Learning organizations borrow best practices whenever possible, but they must be translated into terms that are consistent and in alignment with existing frameworks.

Integration of ISM and HPI

Work planning and control processes derived from ISM*[2] are key opportunities for enhancement by application of HPI concepts and tools. In fact, an almost natural integration can occur when the HPI objectives—reducing error and strengthening controls - are used as integral to implementing the ISM core functions. Likewise the analytical work that goes into reducing human error and strengthening controls supports the ISM core functions.

For purposes of this Handbook, a few examples of this integration are illustrated in the following table. The ISM core functions are listed in the left column going down the table. The HPI objectives appear as headers in the second and third column on the table.

Integration of ISM and HPI

Integrated Safety Management	Human Performance Improvement	
ISM Core Function	Reduce Human Error	Manage Controls
Define the Scope of Work The Task Preview HPI tool supports this core function. It can be used to help eliminate error when reviewing the scope of work. During the task preview individuals who will perform the work: • Identify the critical steps (see definition) • Consider the possible errors associated with each critical step and the likely consequences. • Ponder the "worst that could happen." • Consider the appropriate human performance tool(s) to use. • Discuss other controls, contingencies, and relevant operating experience. This approach is intended to expand the work definition considerations and thus preclude omissions that could be overlooked during analyzing the hazards associated with the work to be accomplished.	When management expectations are set. the tasks are identified and prioritized, and resources are properly allocated (e.g., supervision, tools, equipment, work control, engineering support, training), human performance can flourish. These organizational factors create a unique array of job-site conditions – a good work environment – that sets people up for success. Human error increases when expectations are not set, tasks are not clearly identified, and resources are not available to carry out the job.	When work scope is defined and all the preparation to complete the task is at hand, the error precursors – conditions that provoke error – are reduced. This includes things such as: • Unexpected equipment conditions • Workarounds • Departures from the routine • Unclear standards • Need to interpret requirements Properly managing controls is dependent on the elimination of error precursors that challenge the integrity of controls and allow human error to become consequential.

Integrated Safety Management	Human Performance Improvement	
ISM Core Function	Reduce Human Error	Manage Controls
Analyze and Categorize the Hazards*[3] All types of hazards (e.g., nuclear, industrial, chemical) to workers, the public, and the environment. HPI tools that support this core function including job-site review, pre-job briefing, and questioning attitude. These tools can be used to identify hazards and unsafe conditions before starting a job.	When hazards are properly analyzed during the ISM cycle, the results can be used to analyze the work procedure for latent weaknesses and initiate procedure changes to eliminate those weaknesses. Similarly, robust hazards analysis should consider error precursors in the work place such as: Adverse environmental conditions Unclear roles/responsibilities Time pressures High workload Confusing displays or controls	Reducing latent weaknesses in the procedures strengthens the engineering and administrative controls that are an important cornerstone of the overall defense system. Strong administrative and cultural controls can withstand human error. Controls are weakened when conditions are present that provoke error. Eliminating error precursors at the job site (in the workplace) reduces the incidences of active errors
Develop and Implement Hazard Controls HPI Principle 2, "Error-likely situations are predictable, manageable, and preventable," complements this ISM core function. Hazards are the markings for error-likely situations – a work situation in which there is greater opportunity for error when performing a specific action or task due to error traps. The recognition in HPI that error-likely situations can be managed and prevented supports the ISM core function that hazards are identifiable and controllable. HPI tools that support this core function are self-checking, peer check, procedure use and adherence.	The ISM core function, Implement Hazard Controls, improves conditions at the jobsite. HPI describes the job site as the location where behavior occurs during task performance and is characterized by both environmental and individual factors. Environmental factors include conditions external to the individual and often beyond his or her direct control, such as procedure quality, component labeling, human-machine interface, heat, and humidity. Individual factors include conditions that are a function of the person assigned the task, such as knowledge, skills, experience, family problems, and color blindness.	Hazard controls initiated in the ISM framework are supplemental reinforcements to the engineered and administrative controls and barriers discussed in association with the HPI performance model (Chapter 3). Hazard controls not only help ensure worker and environmental safety, hazard controls also relieve workers from worry, stress, and anxiety when performing work in the face of known hazards. Such conditions provoke human error and mistakes. When hazard controls are in place, worker stress and anxiety drops, human performance improves, and human error decreases.

Integrated Safety Management	Human Performance Improvement	
ISM Core Function	Reduce Human Error	Manage Controls
Perform Work The consistent and effective use of HPI error-reduction tools when performing work reduces the probability that an active error may cause an accident or serious event. Error-reduction tools include among others • Self-checking • Questioning attitude • Stop when unsure • Effective communication • Procedure use and adherence • Peer-checking • Second-person verifications • Turnovers Descriptions of these and other HPI tools are in Volume 2.	This ISM core function supports the third HPI Principle, "Individual behavior is influenced by organizational processes and values." When operations authorization is performed correctly, it can be used as an independent verification of the work planning and control process for specific tasks. Management can use this verification process to ensure that the organizational processes and values are in place to adequately support performance at the job-site (i.e., the task and the individuals are properly aligned and supported to successfully complete the work).	The core value expectation that work can be performed safely is balanced by the first principle of HPI that states, "People are fallible, and even the best people make mistakes." Because people err and make mistakes, it is all the more important that controls are implemented and properly maintained.

Integrated Safety Management	Human Performance Improvement	
ISM Core Function	Reduce Human Error	Manage Controls
Feedback and Improvement The post-job review supports this ISM core function. This HPI tool can help identify the adequacy of controls and point out opportunities for improving work planning and execution. Topics addressed during post-job reviews includes among others: • Surprises or unexpected outcomes. • Usability and quality of work documents • Knowledge and skill shortcomings • Minor errors during the activity • Unanticipated job-site conditions • Adequacy of tools and resources • Quality of work planning/scheduling • Adequacy of supervision Investigating Events Triggered by Human Error is an HPI tool used to find system problems. When a near miss or unwanted event occurs, focusing attention on problems beyond the individual – deeper within the system (e.g., engineering flaws, manufacturing flaws, weaknesses in work processes, ineffective tools, poor work conditions, training shortfalls) helps identify latent or dormant organizational conditions, which, if left unresolved, can continue to provoke mishaps and occurrences.	The fifth principle of HPI is that Events can be avoided through an understanding of the reasons mistakes occur and application of the lessons learned from past events (or errors). Even though errors during job performance are inevitable, they need not lead to events. Seeking to understand the reasons non-consequential errors occur can help strengthen controls and make future performance even better.	Line management and independent oversight are important controls that support "oversight control," the fourth line of defense in the HPI defense hierarchy, as described in Chapter 3. Volume 2, section 3, of the HPI manual describes several management tools used to identify and eliminate organizational weaknesses that weaken controls.

As illustrated in the table above, the integration of HPI methods and techniques to reduce error and manage controls supports the ISMS core functions.

EFCOG Work Planning and Control Program "Guideline Document" (April 12, 2012), Appendix C. HPI and QA

> NOTE: Important concepts in this Appendix are preceded by text notes called "Key Human Performance Points."

Human Performance Issues and Error-Prevention Techniques

When developing work instructions, Work Planners are responsible for specifying the steps that require verifications or documented peer checks in work packages. The Work Planner is also typically responsible for outlining the methodology and sequencing the work to enable personnel implementing the job to keep track of the process described in the work package.

A human-performance trap can arise when multiple actions are imbedded in a single step. A particular challenge occurs when there are bulleted sub-steps and the worker tries to perform them together rather than individually. The preferred method is to have only one action per step of the procedure or work instructions.

Place-Keeping Practices

Place keeping is a recommended tool for work packages with significant consequence of error. Place keeping is particularly important for system status and configuration control as well as reassembly of equipment after maintenance or any situation when the consequences of skipping, repeating, or partially completing a step would result in adverse consequences.

Place keeping is a technique of clearly marking instructional steps in a document being used to control a work activity to indicate the completion status of a particular step. Steps that are not applicable are typically marked "N/A" (per the provisions of the specific procedure).

Some generic but useful place-keeping guidance from INPO 01-002, Guidelines for the Conduct of Operations at Nuclear Power Stations includes the following:

- Integrate appropriate place-keeping techniques in the overall structure of the procedure/work instruction. These should be limited to simple, straightforward methods to support completing the procedure/work instruction in the proper sequence.
- Establish the sequence of steps to conform to the normal or expected work sequence.
- When developing procedures/work instructions, consider the human factors aspects of their intended use. For example, references to components exactly match drawings and label plate identifiers, units are the same as those marked on applicable instrumentation, and charts and graphs can be easily read and interpreted.

Place-keeping tools, such as checkboxes and signoff blanks, should be provided by the Work Planner where appropriate. Copies of applicable technical manual pages should be included in the work packages.

General Guidance:

There are a number of techniques, many of which are already outlined by INPO, that minimize the occurrence of errors. Some common practices to avoid:

- Using check marks instead of initials or signatures for continuous-use procedures, unless the procedure specifically allows it.
- Using ditto marks (").
- Signing one set of initials followed with a vertical line through the remaining sign off blanks.
- Signing off a step as complete before it is actually completed.

Error Prevention Techniques

Remembering and Asking Four Key Questions

Asking the following four questions is often a good way to think through the activity with the goal of minimizing human error:

1. What are the critical steps or phases of this task? (Important parts of the task that must go correctly.)
2. How could we make a mistake at that point? (Identify error precursors.)
3. What is the worst thing that can go wrong? (Review potential consequences and contingencies.)
4. What barriers or defenses are needed? (Use the HPI tools.)

Based on these questions, the Work Planner should consider the use of the error-prevention tools listed below, as appropriate for the work instructions being prepared.

Self-Check:

Stop, Think, Act, Review should be performed for component identification and equipment manipulations as follows:

1. Stop: The individual pauses before performing a task to enhance the attention to detail in an attempt to eliminate distractions.
2. Think: Prior to performing any actions, the individual should verify that the action to be taken is correct by questioning the intended actions and understanding the expected responses. The individual should also point at or touch the component to identify the correct unit, train, and compare to the controlling document.
3. Act: The individual will, without losing physical or visual contact, perform the intended action.
4. Review: The individual will verify that the actual response is the expected response. If an unexpected response is obtained, then action should be taken as previously determined. The individual should ensure that the system/component is in a safe condition.

Peer Check:

Pre-job briefings should discuss and determine the need for peer checks warranted by any of the following:

- Departure from routine,
- Time pressure,
- Something is not right (doubt),
- Apparent conflict between indications,
- Unfamiliarity/first time, and
- Tired/fatigued.

Peer checking can be performed as follows:

1. The performer references the controlling document, locates the component, and verbally identifies each unique identifier on the component label to the peer. The person can point to or touch the equipment to be manipulated during the explanation.
2. The performer references the controlling document and verbalizes the position in which they intend to place (or check) the component.
3. The peer verbalizes the correct component identification and the intended action is correct and people or systems are ready for the action. Note that both individuals should be aware of and understand the status of plant equipment that could be affected by the action.
4. The performer places (or checks) the component in the intended position.
5. The peer witnesses the positioning (or check) of the component and physically verifies the component position or condition, when applicable.
6. When required, the appropriate individual(s) should document completion of the peer check in the controlling document.

Three-Way Communications

The Work Planner should ensure that communications are clear, concise, and free of ambiguity. For non-face-to-face verbal communication, the sender and receiver should identify themselves by stating their name or title. Use of the phonetic alphabet is often required to ensure proper component identification. Three-way communications should be used for all information exchanges that will result in decision making, direction being given, or actions being taken. Words should be avoided during verbal communication that could be mistaken for some other word, such as “increase” and “decrease.” Communication of indicator readings should be provided in the format of parameter - value - trend, (for example: pressure is 100 psig [689.76 kPAg] and going down). The use of sign language should be avoided. The appropriate unit designator, system designator, or noun name and appropriate phonetic alphabet component or train designator should be used when communicating equipment nomenclature, (for example: 1MS029A should be verbalized as “one Mike Sierra zero two nine Alpha”).

First Check

Prior to the performance of the first manipulation of in-field evolutions, as determined by the pre-job brief (typically excluding operator rounds), the proper step intended to be performed, proper unit, proper train, and component should be checked using self-check techniques. Often the worker will also need to contact the control room or dispatching facility to validate component label information.

The work package should reference or establish a method within the dispatching facility to verify each proper step intended to be performed. These checks and communications should then be repeated for subsequent field actions after any of the following as determined by the pre-job brief:

- Initiation of a new section of the procedure with different effects or major components (for example: proceeding to a second feed pump);
- Significant change of location (for example: moving to a different building);
- Significant elapsed time between steps; and
- Change of assigned personnel.

Flagging/Robust Operational Barriers

This process does not substitute for proper self-check using equipment labeling as the indication that the correct component is being manipulated or monitored, nor does it substitute for proper verification requirements determined by plant procedures. It is intended to provide an additional barrier so that when an individual is met with a distraction, they return to the right component prior to continuing work.

Key Human Performance Point: Flagging is best applied for components that will be worked on and manipulated multiple times. Flagging/robust operational barriers are also useful if multiple similar components exist within close proximity and/or will be manipulated multiple times.

Typically, the method needed for flagging/robust operational barriers should be determined at the pre-job brief. The Work Planner can include the method of flagging/robust operational barriers as part of any job, but should also ensure that they will not interfere with plant equipment, including indications for operations. Care should be taken not to create an additional hazard by use of a robust operational barrier device.

Critical Work Package Attributes for Ensuring Quality

As stated in the INPO Human Performance Fundamentals Course Reference:

"Work is planned to anticipate error-likely situations and to incorporate controls that effectively prevent, catch, or mitigate error during the performance of a specific task by specific individuals."

The course reference also suggests the following regarding work planning:

"Identifying the opportunities for error and eliminating them is one of the key responsibilities of those developing procedures and planning work packages. The planning stage of work management is an opportunity to identify critical steps of an activity. The structure of the task can be planned in light of single-error vulnerabilities to reduce possible consequences should people err. Additional controls or barriers can be built into the procedure to prevent or catch errors. Feedback from previous occasions and industry operating experience relevant to the task can be factored into the work plan."

Key Human Performance Point: One key attribute to consistently developing a quality work package is to perform a critical-task analysis.

A critical task analysis basically consists of the following four steps:

1. Develop a task list.
2. Identify and prioritize critical tasks.
3. Identify critical steps of each particular task, considering the following:
   a) Pinpoint error-likely situations at each critical step.
   b) Characterize the consequences if error(s) occurs at the critical step.
   c) Identify weaknesses in or missing defenses.
4. Identify and incorporate needed controls or safeguards.

Other key (or critical) attributes when developing a quality work package may include ensuring the following:

- Content is consistent with the knowledge, skills, and experience of the work force as well as with management expectations.
- WPs are developed with site instructions/procedures, which may include, in some cases, the aid of a writer's guide.
- WPs are reviewed and verified to check for technical accuracy and consistency with the writer's guide, if applicable.
- WPs are validated by qualified users (can the procedure/work instruction be used as written?).
- WPs are current and revised appropriately.
- WPs include relevant operating experience and lessons learned, as appropriate.
- A feedback process is used as a means to continuously improve the quality of the work packages.

-

> Key Human Performance Point: The planner should include contingency plans when deemed appropriate and should recognize that they may not be required with every WP.

When warranted, the Work Planner should include actions to be taken for emergent conditions such as discovery of equipment degradation, additional tools/equipment needed, or increases in the scope of the task. If the potential consequences are significant, job-specific contingency plans should be developed with the WP. Work Planners should consider the following when determining the need and scope of contingency plans:

- What is the worst thing that could happen?
    - **NOTE:** The Human Performance Improvement Handbook, volume 2, stipulates the worst-case consequence <u>should an error</u> occur:
    - Task Preview (page 6) states:
        - "Foresee probable and worst-case consequences should an error occur during each critical step."
    - Technical Task Pre-Job Briefing (page 39) states:
        - Anticipate challenges to human performance for critical activities using S-A-F-E-R
        - Foresee credible as well as worst-case consequences on the facility, on personnel, and on the environment if error goes undetected.
- What defenses/contingencies are in place to address the worst case?

The Work Planner may include actions for coping with potential hazards such as fire, radioactive spills, or exposure to radiation and predictable undesirable events like failures and errors. Contingency plans may be integrated with the appropriate action in the work detail section, if it is more appropriate than keeping them separate. The level of effort and resource used for contingency planning should be commensurate with the significance of the work activity.

Planning for contingency parts should also be considered, and if contingency parts are requested, the appropriate supply chain organization(s) should be notified. Specifically, the supply chain should be made aware of their priority, whether the parts need to be staged on-site, and/or whether the maintenance organization needs to know the availability and lead time so alternative procurement arrangements can be explored. The Work Planner should recognize that contingent material might not be needed to support the planned work activities. However, the material request should still flag the request as "contingent," and the supply chain organization should provide work management with the material availability and lead time so as to allow a cost-effective decision as to whether to procure and/or expedite the material.

Illustration 1

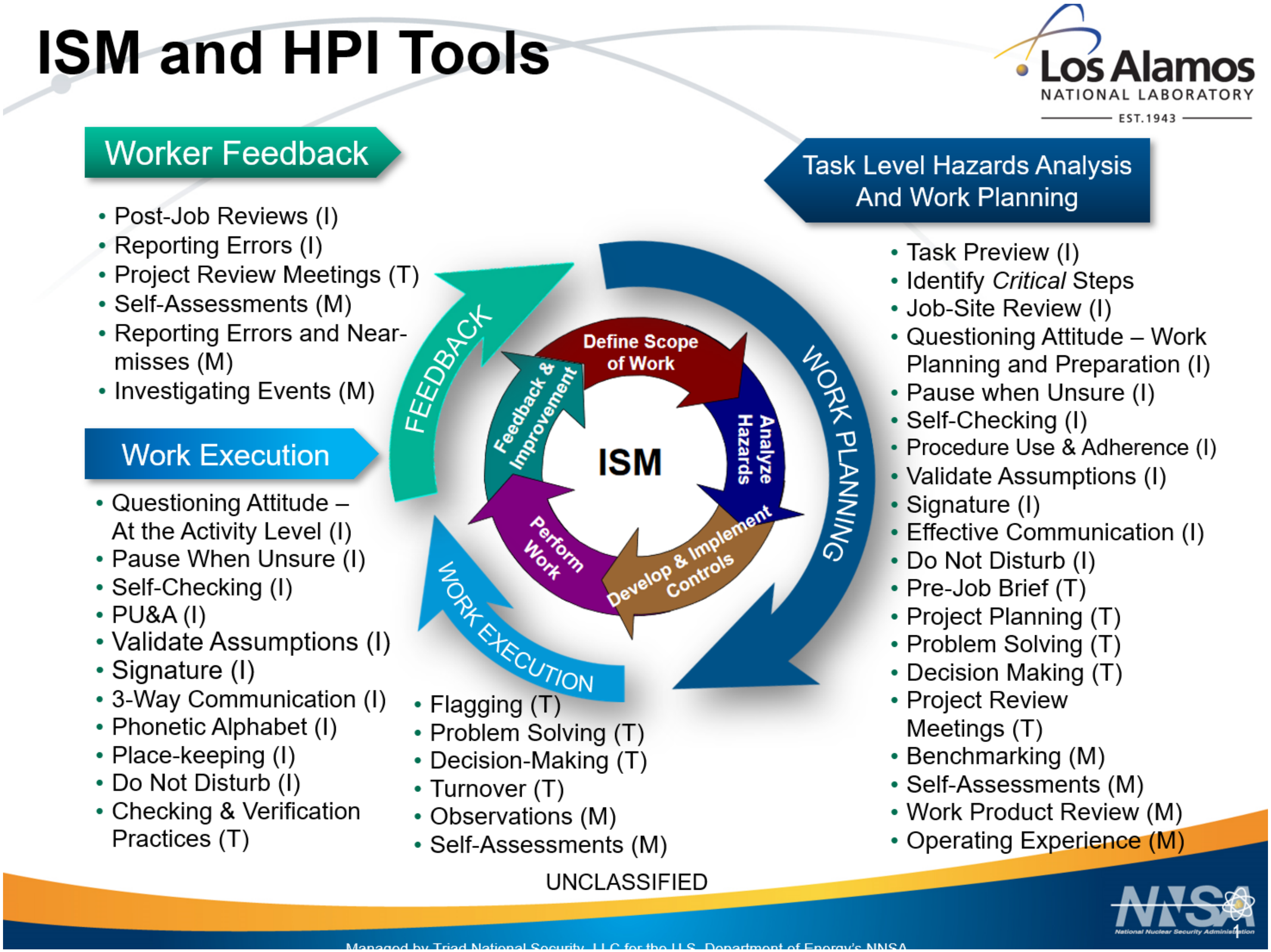


Illustration 2

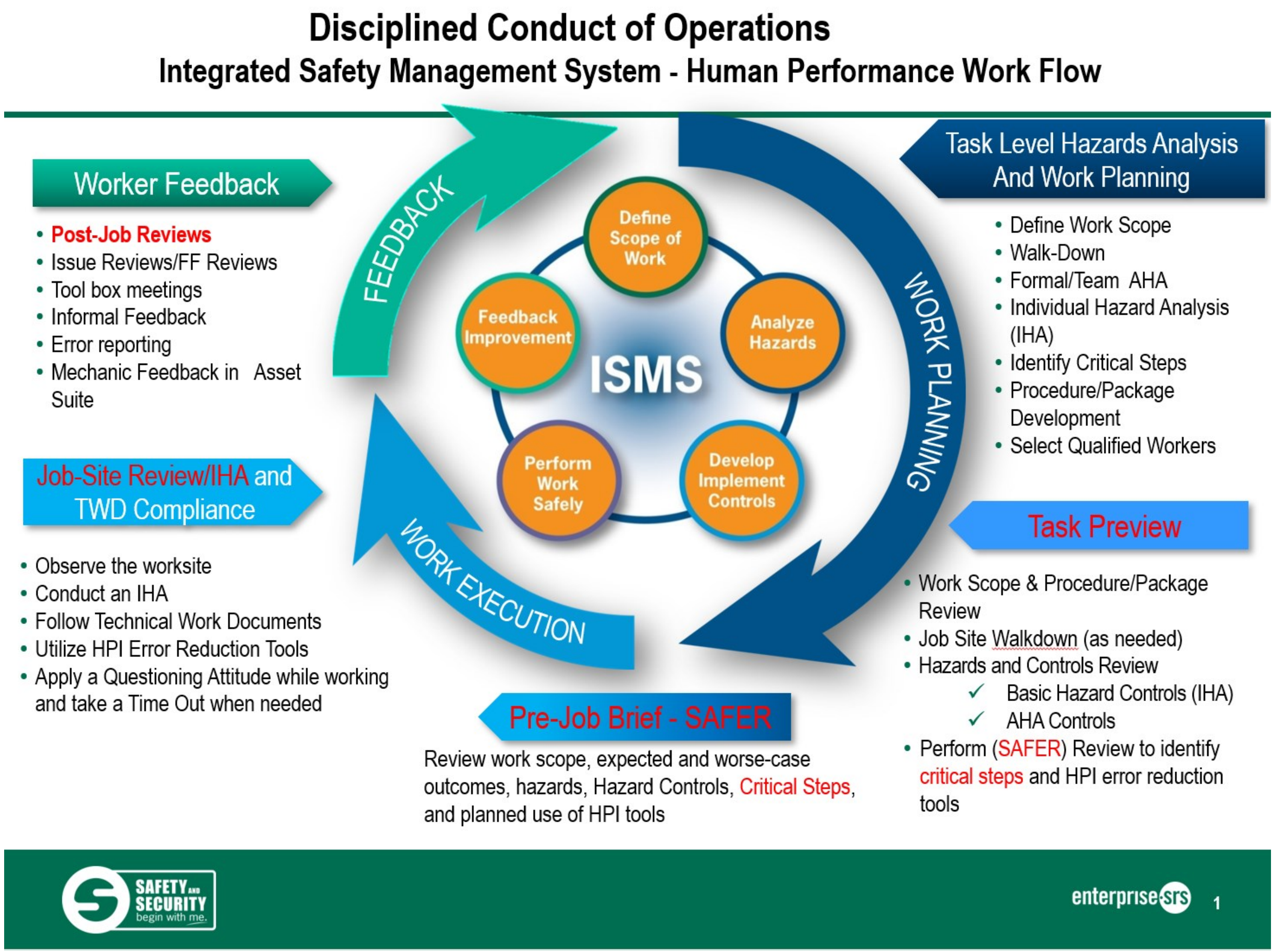


Illustration 3

Workflow from Task Readiness Preparation through Post-Job Review

Prepare

People

Procedures

Work Packages

Other Technical Documents

Plant/Facility

Materials & Supplies

Task Readiness

Complete OSR 3-244, Task Readiness Determination Checklist

- Determine the required:
  - Personnel
  - Equipment
  - Technical Work Docs
  - Training
- Contact other Work Groups as needed
- Supporting documents (Lockouts, RWPs, Confined Space permits, etc.)
- Materials/supplies obtained, inspected and available
- Evaluate Facility configuration

Task Preview

Complete OSR 39-364, Task Preview Checklist

Perform preview:

- Before attending a pre-job brief
- Before starting a job
- After interruptions or extended delays

SAFER Discussion:

Summarize critical and risk-important steps

Anticipate errors and consequences

Foresee worst-case scenarios

Evaluation appropriate HPI Error Reduction Tools

Review experience and Lessons Learned

Pre-Job Brief

Complete OSR 39-31, Pre-Job Briefing Checklist, or equivalent electronic application.

Determine if formal or informal review is needed.

Include all personnel associated with the task.

Conduct as an interactive briefing.

Include all personnel associated with the task and ensure they understand:

- Scope
- Roles and responsibilities
- Critical and risk-important steps
- Error-likely situations and consequences
- Hazards and controls to mitigate
- TWDs associated with task

Job Site Review

Perform visual observation upon arrival at work location:

- Before interaction with risk important equipment
- During walk down of work package
- After extended breaks or interruptions
- Upon discovery of potential safety hazard

Perform an IHA.

Identify:

- Trip-sensitive equipment
- Correct system, equipment, & component
- Critical parameters & indicators
- Error precursors
- Conditions consistent with PJB

Discuss unexpected hazards/conditions and hazard controls.

Perform Work

Perform work in accordance with approved TWDs.

Perform work in a safe, disciplined manner.

Use Manual 2S for procedure compliance guidance.

Use Manual 1Y for work package and work instruction guidance.

Identify potential HPI error precursors.

Use HPI Error Reduction Tools.

Call a Timeout if needed.

Determine level of feedback to perform.

Post-Job Review

Complete OSR 39-351, Post Job Review, or the SOST app (OSR 39-360 for SICAM Reviews).

Determine if formal or informal review is needed.

Perform review when:

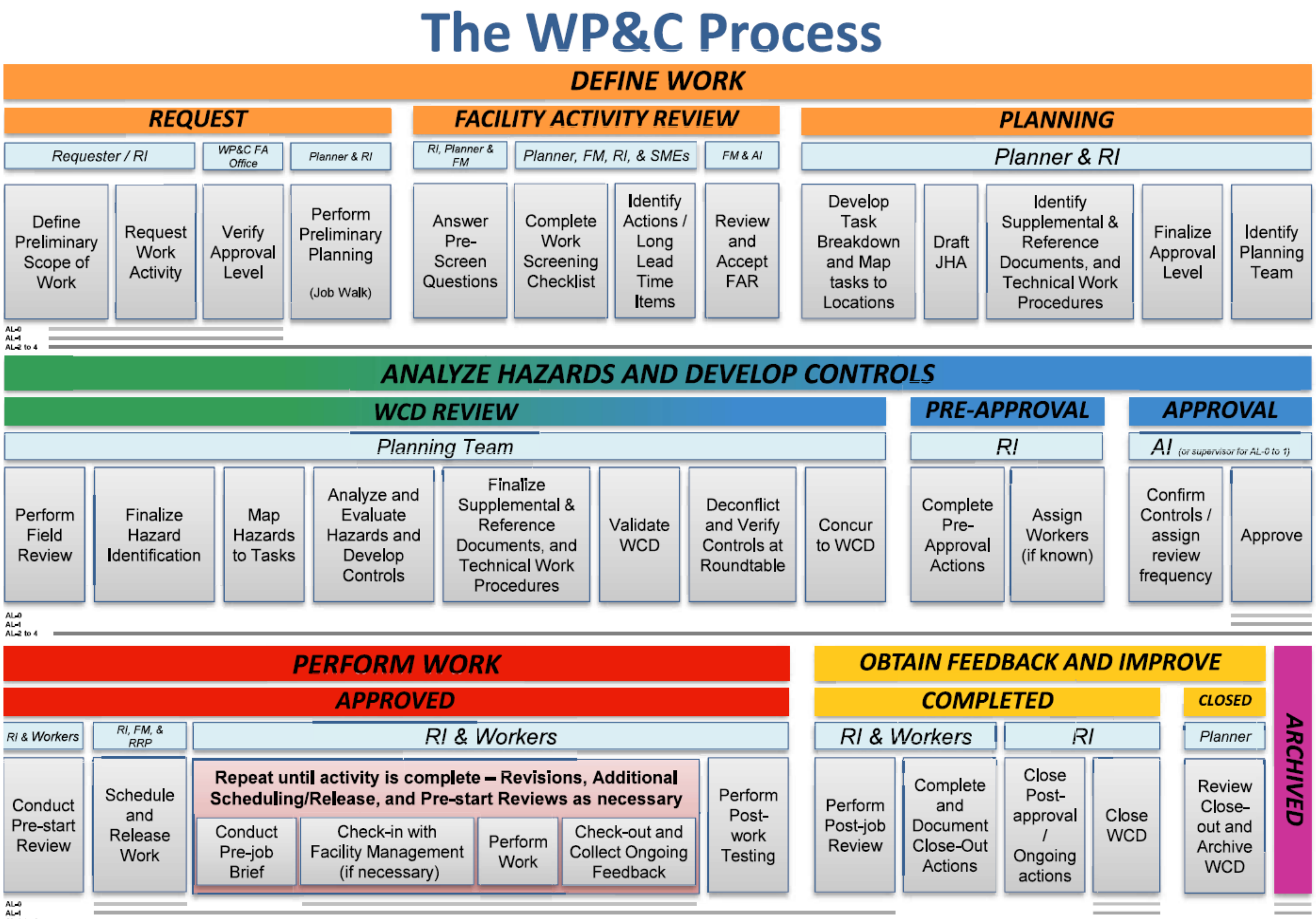
- Complications occurred during work activities
- Task was a non-routine or complex activity
- Task was a high-risk phase of a risk-important project
- Conclusion of emergent work
- Review of routine activities should be performed on some frequency to help with complacency and over confidence.

Post Job Reviews can not be used in lieu of Manual 2S, Procedure 5.2, Issue Investigations.

Detailed guidance is provided in Manual 2S, Procedure 2.1 and Manual 1Y, Procedure 8.20

Daryl Smoldt 06/16/2021

Illustration 4



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Best Practices

Critical Steps:

Authors Tony Muschara, Ron Ferris, and Jim Marinus, in the book "Critical Steps: Managing What Must Go Right in High-Risk Operations" the Amazon.com book description states:

> *Critical Steps happen every day at work and at home, purposefully. Work does not happen otherwise. If an operation has the capacity to do work, then it has the capacity to do harm. Work is energy directed by human beings to create value. But people are imperfect—we make mistakes, and sometimes we lose control of the work. Therefore, work is the use of force under conditions of uncertainty. A Critical Step is a human action that will trigger immediate, irreversible, and intolerable harm to an asset, if that action or a preceding action is performed improperly. Whether the human action involves clicking on a link attached to an e-mail message, walking down a flight of stairs with a newborn baby in arms, engaging the clutch on a gasoline-driven chain saw, or administering a medication to a patient in a hospital, these all satisfy the definition of what constitutes critical risks in our daily lives, professionally or personally. The overarching goal of managing Critical Steps is to maximize the success (safety, reliability, productivity, quality, profitability, etc.) of people's performance in the workplace, to create value for the organization without losing control of built-in hazards necessary to create that value.*

DOE-HDBK-1028-2009, Volume 1,

> Defines a Critical Step as: A procedure step, series of steps, or action that, if performed improperly, will cause irreversible harm to equipment, people, or the environment.

DOE-HDBK-1028-2009, Volume 2,

> Defines a Critical Step as: A procedural step or series of steps or an action that, if performed improperly, will cause irreversible harm to plant equipment or people, or that will significantly affect facility operation. An action that if performed improperly has an immediate negative consequence that cannot be reversed or undone.

DOE-HDBK-1211-2014

> Defines a Critical Step as: An ALWCD work instruction step or series of steps that, if performed improperly, could cause irreversible harm to plant equipment or personnel, or could significantly affect facility operations. An action, if performed improperly, that has an immediate negative consequence that cannot be reversed or undone.

DOE 422.1, Chg 4 Conduct of Operations, states:

> Requirements 2.p.(3) Procedure content, including consistent format and use of terms (e.g. prerequisites, warnings, cautions, notes, hold points, etc.), detail sufficient for accomplishing the operation, technically accurate procedures capable of performance as written, and procedure conformance with the facility design and manufacturer documentation
> Detailed Attributes "k": Critical steps include signature/initial/checkoff blocks, with only one action per block.

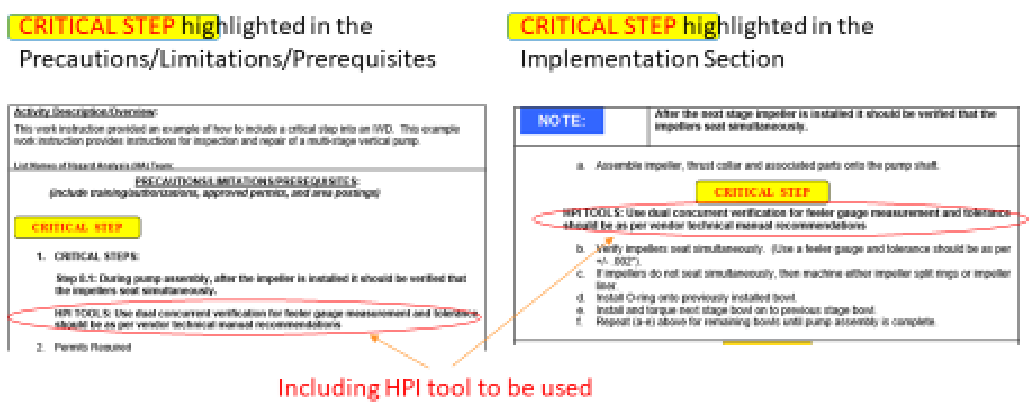
Best Practices

Best Practices for identifying Critical Steps

- Define harm for your organization. Harm is intolerable. Harm could be to assets (people, facilities, equipment, etc.), the ability to accomplish your organization's mission (reputation, national security information, etc.), the environment, or other important criteria.
- Approach each step in the task asking "if this step is performed with an error, will immediate, irreversible, and intolerable harm occur?"

Best Practices for emphasizing Critical Steps

- Highlight the critical step thru formatting such as bolding, warning statements, color, etc.
- Identify that this task contains a critical step in the prerequisites, precautions, and limitations section of the work instructions.
- Consider including a stop or pause point to permit the performer to focus on what must go right as they perform the step or series of steps.



Best Practices for respecting Critical Steps

- Planners, workers, and supervisors must have knowledge of what is expected to happen when the step or series of steps is executed.
- Workgroup personnel are cognizant of any critical steps associated with the activity, the mistakes that can be made at those points, the worst thing that could happen, and the barriers or defenses that are needed [DOE-HDBK-1211-2014]
- Consider the possible errors associated with each critical step and the likely consequences [DOE-HDBK-1028-2009]
- Each worker to describe hazards, controls and critical steps associated with their assignment [DOE-HDBK-1211-2014]

Best Practices

Best Practices for controlling Critical Steps

- Work is authorized and the ALWCD is reviewed so that workers understand the scope of work, including critical steps and associated hazards and controls [DOE-HDBK-1211-2014]
- Consider including a stop or pause point to permit the performer to focus on what must go right as they perform the step or series of steps.
- Critical steps include signature/initial/checkoff blocks, with only one action per block [DOE-HDBK-1211-2014]
- During work execution, the human performance objective is to anticipate, prevent, or catch active errors, especially at critical steps, where error-free performance is absolutely necessary [DOE-HDBK-1028-2009]
- The performer's primary goal is to retain positive control at critical steps when error-free performance is essential for safety [DOE-HDBK-1028-2009]

Human Performance Tools for Critical Steps

- Task Preview (S-A-F-E-R Brief)
- Job Site Review
- Self-Checking (STAR)
- Procedure Use and Adherence
- Place-keeping
- Pre-Job Briefing
- Peer-Checking
- Turnover
- Post-Job Reviews
- Observations

References:

Critical Steps: Managing What Must Go Right in High-Risk Operations, by Tony Muschara (Author), Ron Farris (Author), Jim Marinus (Author)

Best Practices

<u>Taking the human into account</u>

1) Each human is unique and will perform in a unique manner (military excluded).
   a) Familiarity and experience with tasks vary
   b) Proficiency needs to be taken into account
2) Ask better/different questions when identifying Error-Likely Situations
   a) EFCOG HPI Task Team: 20-2, Asking Better Error Precursor Questions for Effective Job Planning, Pre-Job Briefs, and Event Investigations
3) Resiliency (the ability to fail gracefully)
   a) Organizations tend to plan and execute work "administratively". We should be looking at "performance" of work.
4) Consider technology
   a) EFCOG HPI Task Team: 20-1 White Paper - Tech to Reduce Errors
5) Human error can create hazardous situations
6) Procedure Professional Association
   a) www.ppaweb.org
   b) PPA provides opportunities for anyone with an interest in developing best in class human factored procedures and work instructions.
   c) P 907-001, Procedure Process Description
      i) Provides a standard process for creating and altering procedures.
   d) AP 907-005, Procedure Writer's Manual
      i) This document provides a consensus standard for writing human factored procedures.
7) Point, Read, Operate (a form of self-checking)
   a) SRNS Has created a video to demonstrate this practice. Individual gets interrupted. This helps people recognize that you need to do all three as part of operating.
   b) Data Centers call it "Point-Read-Operate."
   c) Other venues' call it "Touch-STAR" or "Verbalize, Point, Touch" (VPT).
   d) Japan Points the Way to Better Safety (Pointing and Calling)
      i) Railways in Japan use a safety system called "pointing and calling." This method of physically pointing toward an item to be checked while vocalizing its name was invented in Japan about 100 years ago. The combination of looking, acting, speaking and hearing reduces errors by as much as about 85%. After recent scientific testing proved the efficacy of the technique, its use spread to fields other than the railways. It's used to increase safety in areas as diverse such as hospitals and construction sites. And now, following its successful adoption by the New York subway system, this unique Japanese safety method is starting to spread around the world. (https://www.youtube.com/watch?v=etUejYb48BE)
8) Performance Modes: Generic Error Modeling System (GEMS) (DOE-HDBK-1028-2008, Volume 1, pages 2-20 thru 2-28)
   a) Panners and job supervisors need to take into account the ***<u>individual's</u>*** performance mode.
      i) Each individual has their own familiarity with the task.
      ii) On any given task, each individual on a team will be in their own individual performance mode.
      iii) Familiarity degrades with the passage of time between performances.

Best Practices

- b) Key take-aways when planning and executing work
  - i) Skill Based (SB) Performance Mode
    - (1) Do NOT confuse SB performance mode with “Skill of the Craft.”
      - (a) Skill of the Craft is a task-based exception to written guidance based on training and experience.
      - (b) SB performance mode is based on that individual performing without conscious attention or control.
    - (2) SB is NOT based on the frequency a task is performed, but it is based on the frequency that THAT INDIVIDUAL performs the task (and has it developed to the point of taking place without conscious control)
  - ii) Rule-Based (RB) Performance Mode
    - (1) Consider the availability and the workability of the rule.
    - (2) Safety (or quality, or production) is not enhanced by the presence of more rules
  - iii) Knowledge-Based (KB) Performance Mode
    - (1) You don’t know <u>*that*</u> you don’t know
    - (2) Look for “triggers”
      - (a) Scratching your head
      - (b) Scratching your chin
      - (c) Looking “up” for answers
      - (d) Saying things like:
        - (i) I think…
        - (ii) I believe…
        - (iii) I am pretty sure…
        - (iv) I am almost certain…
    - (3) You cannot “think” your way out of a KB situation
      - (a) When triggers are present, then Stop And See Out (SASO) information from a knowledgeable, trusted, or informed source outside of your own brain.
    - (4) Examples of KB Tasks
      - (a) First time tasks
      - (b) Infrequent tasks
      - (c) Troubleshooting
      - (d) Initial testing
      - (e) Complex Lockout-Tagout
      - (f) Using a tool not specifically designed for the task

Additional References:

Best Practices

Selecting the right HPI tool for the situation

1) You cannot use all the tools all the time. Similar to a "tool box full of hand tools" the performer must select the right tool for the situation (e.g. wrench), use it correctly (apply counter-torque), in order to achieve the desired outcome (nut/bolt tightened).
2) The over-use of HPI tools, such as self-checking or peer checking every step, degrades their effectiveness.
3) Disciplined implementation is necessary for HPI tools to be effective. Therefore, training on proper performance may be required.
4) Ensure the workforce understands the difference between *Stop/Pause Work* as described in 10 CFR 851 and DOE-HDBK-1028-2009
    a) 10 CFR 851: Worker Safety and Health Program, Subpart C,
        i) § 851.20 Management responsibilities and worker rights and responsibilities,
        ii) (b) Worker rights and responsibilities. Workers must comply with the requirements of this part, including the worker safety and health program, which are applicable to their own actions and conduct. Workers at a covered workplace have the right, without reprisal, to:
        iii) (8) Decline to perform an assigned task because of a reasonable belief that, under the circumstances, the task poses an imminent risk of death or serious physical harm to the worker coupled with a reasonable belief that there is insufficient time to seek effective redress through normal hazard reporting and abatement procedures; and
        iv) (9) Stop work when the worker discovers employee exposures to imminently dangerous conditions or other serious hazards; provided that any stop work authority must be exercised in a justifiable and responsible manner in accordance with procedures established in the approved worker safety and health program.
    b) DOE-HDBK-1028-2009, DOE HPI Handbook Volume 2, Pause When Unsure
        i) DOE facilities have formalized Stop Work processes. These are intended for use by activity level workers when they believe conditions may be unsafe. They are also intended to be used by the organization in circumstances where work may need to be postponed for re-analysis and subsequent safety improvements prior to resuming work.
        ii) The Pause When Unsure tool is intended to supplement the existing formalized practices and emphasis that workers approach work deliberatively and mindfully. And if they encounter unexpected conditions or need additional clarification or support, then pausing is a recommended and conservative approach.
        iii) The "Pause When Unsure" technique prompts performers to gain more accurate information about the work situation from other knowledgeable persons before proceeding with the activity. It involves a stoppage of work long enough to allow individuals, their supervisors, or other knowledgeable persons with expertise to discuss and resolve the issue before resuming the task.

Best Practices

5) Planners and supervisors need to understand the value added by each tool so that the correct tool is selected. For example:
   a) Independent Verification is not an appropriate tool for critical steps. If an error occurs during performance the independent verification (separated by time and distance) is too late to preclude the consequence. On the other hand a peer check (or concurrent verification) is in the moment and the peer can intercede to prevent the error by the performer.
   b) The level of procedure use (continuous use or reference use) should be determined by the risk associated with the task should an error occur during performance). If the consequence is tolerable and recoverable, then a reference use procedure may be the best option. However, if the consequence of an error is intolerable then a continuous use procedure should be selected. In some cases, a hybrid use level may be necessary to avoid unnecessary burden, yet maintain positive control when required.
   c) The use of Flagging and/or Robust Operational Barriers (Blocking) should be prescribed when look-alike equipment is involved.
      i) Flagging can be used for IT applications. Computing equipment has racks and cards. When you take out a card, you lose eye contact, so that when you return to the rack.
      ii) Flagging/Blocking really helps in a distractive environment (because components look identical/similar)
      iii) Electrical Company: Technicians had a “Flagging KIt”. It contained all different types of flagging. Temporary labels, different color tapes, plastic mini-clips. Etc.
         (1) NOTE: These items can be used for verification practices too.

Best Practices

Pre-Job Brief

1) Pre-job Briefs are commensurate with the frequency, complexity and risk. A graded approach is recommended.
2) Preparing for a Pre-Job Brief
   a) The supervisor or designee should familiarize themselves with various aspects of the activity prior to conducting the pre-job brief. [DOE-HDBK-1211-2014, section 6.6.2]
   b) Workers should prepare (e.g., Task Preview) prior to attending the Pre-Job Brief
      i) A PJB should not be the first time a person is aware of the task.
      ii) Workers should do a "Task Preview" prior to attending a PJB
      iii) Send documentation ahead of time for review
   c) Invite worker's, support staff, and key stakeholders
3) Conducting a Pre-Job Brief
   a) Pre-job briefings should be conducted
      i) 48 CFR 970.5223-1(c)(4), 10 CFR 830.122.e, 10 CFR 851.25(a),
      ii) DOE O 433.1B, Attachment 2, para. 2.d,
      iii) DOE O 422.1, Attachment 2, Appendix A, Para. 2.l..
      iv) DOE-HDBK-1211-2014, section 6.6.2
   b) The pre-job brief should be conducted in a work environment that fosters attention and participation. [DOE-HDBK-1211-2014, section 6.6.2]
      i) Close to where the work is occurring using pictures if not able to be at work location.
   c) Pre-Job Briefs should be brief
   d) Pre-Job Briefs should be interactive
      i) For more information regarding the reverse pre-job briefing process, refer to URS – Nuclear Waste Partnership LLC, outlined in WP 04-AD30303, Pre-Job & Post-Job Reviews. [DOE-HDBK-1211-2014, section 6.6.2]
      ii) The workgroup (e.g., supervisor or designee, workers and support personnel) then conduct an interactive pre-job brief using all of the necessary documentation, (e.g., ALWCD, RWP, permits) to review and confirm the workgroup's readiness to perform the activity. [DOE-HDBK-1211-2014, section 6.6.2]
      iii) Create psychologically safe environment
      iv) Ask open ended questions to promote dialogue
      v) Ask each participant if they have questions
      vi) Consider physical and mental state – address any error precursors
         (1) Best practice: worker-led pre-job brief
      vii) Discuss hazards, controls, critical steps and responses to unplanned events
4) Things to consider:
   a) Causal analysis sometimes points the PJB (something is missing). In many PJB's we talk about WHAT we are going to do (hazards, controls, etc.) however we may not talk about HOW we are going to do the work (How we are going to implement those controls for the hazard)
   b) Pre-Task Analysis for vendor work, where actual content that is included and may have even been "discussed", but when it comes to implementation…did they actual discuss this hazard (e.g., pinch points) adequately to actually control the hazard. For example, when "communication" is used as a hazard control.

Best Practices

c) What if English Second Language for the worker?
d) Should boilerplate hazards be included? It adds noise to the conversation. Consider taking job planning to the "task level." DOE-HDBK-1211-2014 which states to "Look at the "steps" and the controls necessary to implement the task."
e) Document the "next PJB" at the conclusion of the current PJB.
    i) The PJB form contained information that the people doing the work felt was important (FUBU: For Us By Us). This form(s) included where to find necessary tools and equipment, a list of alarms that operations would get. The information was stored on a departmental shared drive; that was open to all technicians. This was in addition to the Work Order. Feedback on the work order was given to the planners.
    ii) A second practice (for PM's and Surveillances) had a "surveillance box" that contained all the tools and documents necessary to perform that surveillance/PM.
    iii) These ideas are personally beneficial (WIFFM) to the workers.

Best Practices

A Learning Organization

1) The people who do the work and the most knowledgeable about the work
2) Not all plans work out like you thought they would.
   a) Work as done/performed is not always the same as work as planned/imagined.
   b) Capture the surprises, deviations, adjustments, etc.
   c) Understand why it happened that way.
3) Feedback provides the opportunity to adjust
   a) Maximize continual improvement and learning with robust feedback and improvement processes. [DOE-HDBK-1211-2014, section 6.0, goal #6]
   b) Open and effective communications, constructive feedback, and due consideration of diverse opinions should be encouraged at all organizational levels. Individual ownership, accountability, teamwork, continuous improvement, and proactiveness to prevent or address and correct issues before they become major are visible traits of a safety-conscious culture. [DOE-HDBK-1211-2014, section 6.1]
   c) Using feedback during task planning
      i) Work Planner (Preparer) reviews lessons learned and feedback information for entries with applicability to the work to be performed. [DOE-HDBK-1211-2014, section 6.1.1]
      ii) JHA's should include a review of maintenance/equipment history, relevant lessons learned and other forms of feedback to assist in identifying hazards and controls; [DOE-HDBK-1211-2014, section 6.3.3.2]
      iii) The most recently closed ALWCD, with any associated feedback, should be used by the work planner or planning team as a model ALWCD the next time similar work is performed. Prior to each use, model ALWCDs are to be reviewed to ensure the accuracy of the task. The review incorporates safety feedback for improvement, previous comments, operating experience, activity-specific information and appropriate authorization, approval, and release prior to execution. [DOE-HDBK-1211-2014, section 6.4.3.2, Model ALWCD]
      iv) Sources of lessons learned should be reviewed to identify specific lessons learned for incorporation or use in planning work activities. Corporate databases supported by the Office of Health, Safety and Security are listed on http://energy.gov/hss/services/reporting. [DOE-HDBK-1211-2014, section 6.7.2]
   d) Capture feedback during work execution (while it is fresh in your mind), particularly insights from: [DOE-HDBK-1211-2014, section 6.6.3.2]
      i) Work interruptions (Pause Work/Stop Work);
      ii) Work delays (such as unavailability of material, support personnel, work area access);
      iii) Work clarification;
      iv) Progress/status and turnover of work completed – daily or per shift; and
      v) Documentation of unexpected events or conditions encountered during the performance of the activity.

e) Upon work completion
    i) Reviews are conducted to collect feedback, including lessons learned
        (1) 48 CFR 970.5223-1(b)(2) and (c)(5).
        (2) 10 CFR 830.122(c), (d) and (e).
        (3) DOE P 450.4A, and DOE O 433.1B, Attachment 2, para. 2.l and 2.o).
        (4) DOE-HDBK-1211-2014, section 6.7.1.
    ii) Workers participate in the post-work review and identifies feedback and process improvement opportunities to the Work Supervisor (WS). [DOE-HDBK-1211-2014, section 6.1.1]
        (1) Potential Questions to ask to draw out context:
            (a) Tell me about your work experience. What went well?
            (b) What was difficult?
            (c) Were the instructions usable?
            (d) Did anything unexpected occur or make you feel uneasy?
            (e) What ideas do you have to make things more efficient?
    iii) Post-work reviews are the chief information source for lessons learned (both positive and negative) from every work activity. The goal of these reviews is to improve WP&C processes and their implementation. The post-work review process should include participation by appropriate workgroup members. Items to discuss include what went right, what went wrong, and what can we do to improve. The results should be documented and catalogued so they may be used by the organization to implement lessons learned in future work activities. [DOE-HDBK-1211-2014, section 6.7.1]
    iv) Post-Job Reviews should be interactive. An "After Action Review:" is a good technique.
        (1) What was expected to happen?
        (2) What actually happened (good, bad, and surprises)?
        (3) Do we understand why it happened this way?
        (4) What did we learn?

f) Documentation
    i) Feedback and lessons learned information is analyzed to identify improvement opportunities. Improvement opportunities are effectively implemented (see 48 CFR 970.5223-1(b)(1), (c)(2) and (c)(5), 10 CFR 830.122(c) and (d), DOE P 450.4A, and DOE O 433.1B, Attachment 2, para. 2.o and 2.p). [DOE-HDBK-1211-2014, section 6.7.2]
    ii) Documentation associated with the planning and execution of completed work, including feedback and lessons learned information, should be archived and easily retrievable to allow it to be used in the planning of similar work activities in the future. [DOE-HDBK-1211-2014, section 6.7.2]

g) Education
    i) ANL Micro Learnings
        (1) Short duration (30 minutes or less),
        (2) One topic focus (targeted and structured around that topic),
        (3) Supplements an overarching training (big picture), where the Micro-Learnings are a deeper dive into these topics
        (4) Presentation is intended to be conversational

(5) Offerings are highlighted at daily email (snapshot) and forums, and targeted emails to work planners and PIC's
(6) Opportunity to integrate HPI into WP&C topics

h) Additional References

i) Pre-Accident Investigations: An Introduction to Organizational Safety by Todd Conklin (Author)

ii) Pre-Accident Investigations Better Questions: An Applied Approach to Operational Learning, by Todd Conklin (Author)

iii) The Practice of Learning Teams: Learning and improving safety, quality and operational excellence, by Brent L. Sutton (Author), Mrs. Glynis McCarthy (Author), Brent M. Robinson (Author), and Dr. Todd E. Conklin (Foreword)

iv) Operational Learning Journal for HOP and Learning Teams, by Brent L. Sutton (Author), Mrs. Glynis McCarthy (Author), Brent M. Robinson (Author), and Dr. Todd E. Conklin (Contributor)

v) Learning from Everyday Work: New View of Safety Discussion White-paper (Learning Teams), by Brent L. Sutton (Author), Brent M. Robinson (Author), Jeffrey Lythand (Author), and Dr. Todd E. Conklin (Contributor)

vi) Bob's Guide to Operational Learning: How to Think Like a Human and Organizational Performance (HOP) Coach, by Bob Edwards (Author), Andrea Baker (Author)

vii) Do Safety Differently, by Sidney Dekker (Author), Todd E Conklin (Author)

Best Practices

Work Implementation – The Human Element

1. Surprises during Work
    a. LBNL event where a clamp vibrated and fell off due to grinding activities (Vibrations) a few components away. The work they were doing created a new hazard
    b. Typically, organizations consider what hazards can be created from the work they are about to do.
    c. However, Not recognizing an OLD Hazard (latent condition) that may impact current work.
2. Mindful work execution
    a. No routine tasks – lots of frequent tasks
    b. But there is always something different
    c. Ber careful of the work "just." Examples include "I just needed to ___________"
3. Trigger Training (HOPE Consulting and others)
    a. Hope Consulting Trigger Training description
        i. Trigger Training® is multi-industry applicable training that enhances one's ability to identify visible cues that precede an undesirable event and the steps to take to get the assistance needed before proceeding. These triggers (visible cues) cause uncertainty and a pause or hesitation in work activities which, if properly responded to, allows for risk evaluation and prevention of undesirable events.
        ii. Trigger Training ® is designed to aid all employees in identifying when they may be in a state of uncertainty triggering them to STOP and seek assistance. HOPE Consulting has found that typically there are "triggers" that precede an undesirable event. Also, many people state in interviews after an event, they were "certain" they were on the right path! Some have said they do not believe you can know when you are in uncertainty space when "you don't know, what you don't know." HOPE Consulting has an answer to this challenge via a 4 hour course based on industry operating experience.
    b. https://hopeconsultingllc.com/high-reliability-training
4. Organizational Work Planning Practices
    a. Management Awareness Tool (MAT) - Argonne National Laboratory:
        i. The intent of the Management Awareness Tool (MAT) is to drive conversations about upcoming work and associated risks, where the discussions cover more than health and safety and occur at all levels of the organization. It increases awareness about upcoming work that may pose a higher-than normal risk for the variety of reasons suggested below:
        - Financial risk due to possible damage to a high-cost component or immediate effect on funding levels
        - Reputational risk if a high-profile activity fails
        - Schedule risk due to needing to meet an important milestone deadline, working with time sensitive material, or executing under a compressed schedule
        - A unique, one-off, or non-routine activity may increase risk if it falls outside the traditional work scope for a group or division
        - A first-time iteration may increase risk for jobs not inherently low hazard

- Complexity due to scaling up a process or work involving many hazards not routinely encountered together
- Before restarting paused or stopped work when senior management is involved
- Management interest due to senior management being involved in the planning stage and wanting to know when this work will occur
- Other factors related to risk (not mentioned above), such as experience of staff performing the work, familiarity of staff with the hazards, staff turnover, distractive factors (such as the holiday season), and the potential effect on the environment.

ii. The MAT generates a weekly schedule report that groups projects by upcoming work with planned dates and scheduled or current work dates which helps address and plan for impacted co-located work.

b. SANDIA Multi-organizational work agreement: – get people to think about the interfaces with other groups and the impact to and from those other organizations. It's a tool that SANDIA has introduced and socializing. Some places it is required, and others are encouraged. It is a newer tool and does not have adequate runtime to determine effectiveness. Tool is being piloted in December 2022.

c. LANL: RN300-01 - Rehearsal of Concept Drill

i. The purpose of the Rehearsal of Concept (ROC) Drill process is to ensure a high degree of operational preparedness prior to the actual performance of high hazard/complex (see P300, Integrated Work Management, Attachment A, Hazard Grading Table, for more information) and mission essential work activities, to ensure effective, safe, compliant, and high-quality work execution outcomes.

ii. The objective of the ROC Drill is to ensure operational work is well planned and coordinated to ensure the effective and moreover the safe, compliant and high-quality execution of work at LANL; as such, if deemed beneficial, the ROC Drill concept may be applied to any operational work activity.

iii. The ROC Drill is a tool that may be utilized to provide a thorough and robust Dry-Run/Walkdown and Table-Top Review of the work activity by all involved organizations, stakeholders, and appropriate SMEs, prior to the execution of high hazard, complex and mission essential work evolutions. It provides LANL the opportunity to identify potential work execution issues or "gaps," in order to anticipate and mitigate unintended adverse consequences to personnel, environment, equipment, property or mission. Anyone may request a ROC Drill, but the decision to perform the drill is at the discretion of the applicable Facility Operations Director (FOD)/FOD Designee and/or Associate Laboratory Director (ALD) representative (leading and executing the operational activity).

iv. The ROC Drill involves and actively engages the executing and affected ALD(s), FOD(s), and specifically the personnel performing and supporting the work evolution (e.g., Superintendents, Foremen, Persons in Charge [PICs], Craft, Subcontractors, Planners, Radiation Control Technicians [RCTs], Industrial Hygiene [IH], Engineering, Waste Management), to verify LANL's preparedness to successfully execute the work and ensure a shared understanding and accountability of the execution plan.

   d. SRNS: AHA process, performance analysis process that tries to identify the issues that previously were below the radar.
5. HPI tools for implementing work
   a. Job site review (2-minute drill)
   b. Questioning Attitude
   c. Stop when unsure (Stop and Seek Out)
   d. Hold Points
   e. Critical Step execution
6. Research and Experimenting activities
   a. Risk is difficult to accurately project risk. Consider "theoretical hazards" and account accordingly
   b. Consider using software to aid in hazard identification and incorporating into the work control plan/documents (NOTE: Software could have programming flaws – Trust but validate software results)
   c. Research typically does not have a procedure to refer to during planning. Instead, the experiment is implemented thru guidelines and heuristics.
   d. Hazard mitigation may be on a range of quantity, not necessarily a specific quantity.
   e. Research is conducted in a "Safety Envelope". How do you keep them in the envelop and how do they recognize when they are approaching or have left the envelope boundary? Small group conversations are an effective tool to keep researches in the safety envelope.
   f. In addition to typical consequential "what if" questions, Research is fluid, so "what if" questions are an effective tool as the research demands a change in the approach.
   g. Job site walkdowns with SME's (e.g., Safety Professionals) concurrently walking-down the experiment provides an opportunity for diversity of thought and multiple perspectives.
   h. There may be situations that require "novel equipment" (one of a kind, first one of it's kind). Therefore, reference documents may not be available to use during a hazard evaluation. These situations may require an independent technical assessment using existing reference information. (JLAB)
      i. [TUV, CSA, UL, ETL, and many others are good. OSHA has the current list of approved NRTLs. https://www.osha.gov/nationally-recognized-testing-laboratory-program/current-list-of-nrtls
   i. User facilities need to take into account the user's equipment that will be used in your facility.
   j. Consider operational practices (LOTO) when adjusting research equipment. How do you plan activities that are required for research? Particularly if the equipment needs to remain energized to adjust it.
7. References
   a. Do Safety Differently, by Sidney Dekker (Author), Todd E Conklin (Author)