



U.S. DEPARTMENT OF  
**ENERGY**



ISM Workshop on Activity-level Work Planning and Control (WP&C)

# Analysis of ISM Activity-level Work Planning and Control Within DOE

Stephen L. Domotor  
Office of Analysis  
Office of Health, Safety and Security

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- Background
- Purpose and Objectives
- Analysis Lenses, Data Sets, & Methodologies
- Observations
- Conclusions
- Recommendations



## ISM Workshop on Activity-level Work Planning and Control (WP&C)

- On August 18, 2012, the Defense Nuclear Facilities Safety Board (DNFSB) sent a Technical Report, *Integrated Safety Management at the Activity Level: Work Planning and Control* (DNFSB/TECH-37), to the Department of Energy (DOE) regarding its views on DOE's need to improve activity-level work planning and control (WP&C).
- On November 30, 2012, DOE replied to DNFSB, committing to undertake three tasks, supported by six subtasks, to improve, strengthen, and influence effective implementation of activity-level WP&C.



The HSS Office of Analysis was tasked with responding to Action 1b: Analysis of WP&C Deficiencies Identified by the DNFSB.

- Conduct an analysis of the WP&C deficiencies identified by the DNFSB to determine common trends, causal factors, or systematic weaknesses with DOE's WP&C processes or implementation.
- In addition, review the Occurrence Reporting and Processing System (ORPS) for the last three years to determine if there are any common trends or areas of weaknesses with WP&C.
- Based on the results of these two analyses, identify specific corrective actions to address the findings.



### DNFSB/TECH-37

- DNFSB Staff Reviews of DOE Sites and Projects
- DOE Accident Investigations
- DOE Documents: Follow-on DOE and Contractor Assessments of WP&C

### ORPS

- Cause Codes
- Keywords
- Review of ORPS Reports

### Safety Culture Assessments (secondary data source)

- HSS Extent of Condition Reviews

*Note: The principal data sources applied in this analysis are from assessments, and from reports of operational incidents that had already taken place. As such, this analysis did not address the preponderance of cases where work was performed safely and without incident.*



# Observations





HSS analyzed the Accident Investigation and DNFSB Staff Review sections within DNFSB/TECH-37 to identify common causal factors.

Key observations:

- Less than adequate identification and communication of hazards
- Work Control Documents (WCDs) that do not properly characterize the hazards
- WCDs that do not effectively identify/communicate hazard controls, or controls already in place to prevent accidents or injuries
- Work planning that does not integrate previous operating experience into the early work planning stages



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### Observations from the analysis of DOE Documents:

- Issues with adequacy of procedures and documents established by contractors to plan work, and WCDs developed through the planning process
- Failure to adequately identify activity-specific hazards, and controls not tailored to the specific hazards
- Over-reliance on computer based hazards analysis tools and predetermined (canned) controls
- Poor quality WCDs, with confusing, out-of-sequence, or incomplete work steps
- Lack of worker and subject matter expert (SME) involvement in WCDs
- Procedures that are too broad in scope create the vulnerability that work will be performed outside of the intent of the WCDs
- Poor quality of WCD verification and validation





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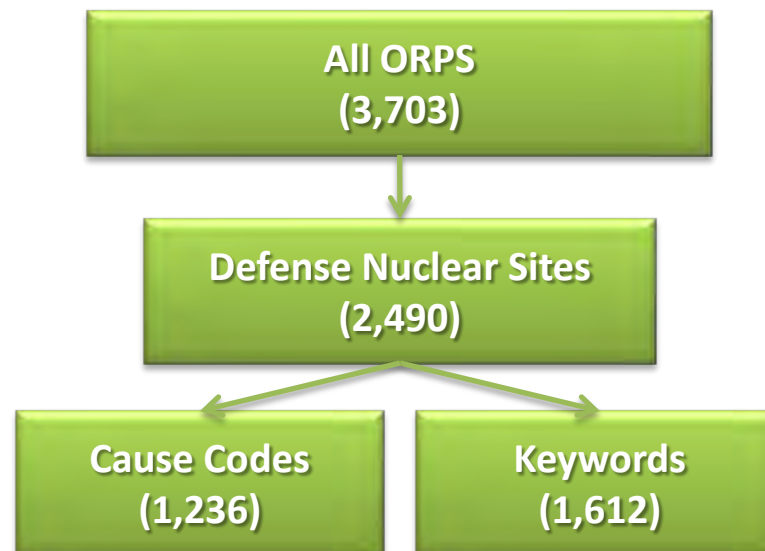
- Supervisors not enforcing compliance with WCDs or initiating stop work when needed
- Workers not questioning supervisors when work instructions lack clarity; and not exercising stop-work authority
- Procedural non-compliance, with work performed outside of work controls, and workers not exercising stop work authority
- Verbal communication issues between work groups, and between managers and workers
- Lack of effectiveness reviews to ensure corrective actions associated with WP&C are resulting in improvements
- Lack of incorporation of lessons learned into future WP&C
- Lack of rigor in some DOE and contractor assessments of WP&C



The Occurrence Reporting and Processing System (ORPS) is the database into which DOE sites enter all reportable occurrences.

ORPS occurrence reports were analyzed for the three-year period January 1, 2010 through December 31, 2012.

The data set was filtered to identify ORPS reports from DOE defense nuclear facilities, and further filtered by cause codes and keywords related to WP&C.





- When the reporting organizations finalize ORPS reports, they are required to select one or more Cause Codes that apply to the event.
- HSS selected and filtered ORPS reports by Cause Codes that best relate to activity-level WP&C.
- HSS analyzed the data to determine the most prevalent cause codes associated with activity-level WP&C occurrences. To better understand the causal relationships in activity-level WP&C occurrences, an analysis was performed by combining Cause Codes identified in ORPS reports into “Cause Code pairs.”



Results of the Cause Code pairs analysis are shown below in order of predominance. All of the top five Cause Code pairs referenced the Cause Code *Management policy guidance/expectations not well-defined, understood or enforced*.

CAUSE CODE 1
Management policy guidance/expectations not well-defined, understood or enforced

+

CAUSE CODE 2
Verbal communication between work groups less than adequate
Written communication incomplete/situation not covered
Check of work less than adequate
Management follow-up or monitoring of activities did not identify problems
Job scoping did not identify special circumstances and/or conditions



- HQ Keywords (Keywords) are assigned daily by the HSS ORPS Analysis Team.
- Keywords represent descriptive operational areas that may have affected, or been affected by, the occurrence.
- In this portion of the analysis, ORPS occurrences are organized and filtered by groups based on HQ Keywords relating to WP&C, each group comprised of one or more Keywords.



The results of the ORPS Analysis by WP&C-related Keywords are shown below in order of predominance.

- Procedures and Documents
- Supervision and Management
- Work Planning
- Personnel Errors
- Procedure Compliance
- Safety Compliance
- Communication





Assessments of nuclear safety culture at DOE defense nuclear projects and sites revealed insights about work planning and control that align with results from principal data sources applied in this analysis.

Observations include:

- Schedule pressures and other factors such as inadequate planning, frequently shifting priorities, and inadequate work packages
- Communications issues
- Improvement needed in learning from operating experience and lessons learned
- Unwillingness by workers to raise concerns



# Conclusions



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- The analysis of multiple data sources utilizing different lenses of analysis identified a recurring set of activity-level WP&C deficiencies across the DOE Complex for Defense Nuclear Facility operations.
- Five main categories of deficiencies were identified:
  - Hazard Identification and Hazard Control
  - Procedures and Documents
  - Supervision and Management
  - Communication
  - Feedback and Lessons Learned
- These five main categories of deficiencies are symptomatic of management system weaknesses in WP&C.



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### Hazard Identification and Control

- Failure to adequately identify activity-specific hazards, and controls that were not germane to or appropriately tailored to the specific work activity
- Lack of SME involvement in hazard identification and control development

### Procedure and Document

- Procedures and documents used to guide WP&C development were sometimes inconsistent or not fully utilized
- Poor quality of WCDs that were too broad in scope and/or lacked specific work instructions, including incomplete, vague, or generic work step sequence logic
- SMEs were not utilized in the development of WCDs



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### Supervision and Management

- Management guidance and expectations were not well defined, understood, or enforced
- Supervisors not ensuring worker compliance with WCDs or not initiating stop work when necessary
- Supervisors became physically involved in performing work tasks, lessening their ability to provide direction and oversight

### Communication

- Lack of communication between and within work groups, and between supervisors and workers, contributing to work execution errors
- Workers faced with poorly written WCDs did not demonstrate a questioning attitude or exercise stop work authority when necessary
- Workers improvised procedural steps in order to complete work rather than stopping for clarification when faced with ambiguous instructions



### Feedback and Lessons Learned

- Lack of incorporation of lessons learned from previous operating experience into future work planning and development of WCDs
- Ineffective pre- and post-job briefings
- Less than adequate contractor effectiveness reviews to ensure that corrective actions were indeed effective
- Need for improved rigor in some DOE and contractor assessments of activity-level WP&C





# Recommendations



#### Contractor Management

- Establish and maintain independent Hazard Review Teams to conduct technical reviews of existing procedures and processes for identifying and analyzing activity level work hazards, and for determining appropriate controls. Identify corrective actions, implement improvements, and verify that improvements are effective.
- Evaluate the use of automated/computerized job hazards analysis tools for their effectiveness and currency in addressing hazards associated with activity level work.
- Ensure appropriate SMEs and workers are involved throughout the hazards identification and analysis process during the development of WCDs.

#### Line Programs and HSS

- Develop lines of inquiry within CRADs to ensure contractor actions taken in response to the previous recommendations are effective.



### Contractor Management

- Review the effectiveness of and improve the approach to planning work and developing and approving WCDs through a collaborative team approach involving SMEs, workers, and supervisors. Ensure improvements are incorporated into organizational WP&C programs and processes. Provide training on improved work planning and WCD development processes.
- Ensure individuals responsible for WCD approval have the competencies for evaluating the workability of WCDs, and provide mentoring and training as needed to strengthen these competencies.

### Line Programs

- Establish measures to evaluate and trend WCD quality and WCD implementation to identify best practices as well as areas for continuous improvement.



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#### Contractor Management

- Reinforce expectations regarding the critical role of supervision of work versus the performance of work, emphasizing the important role that supervisors play in the safe conduct of work.

#### Line Programs

- Incorporate performance expectations for activity-level WP&C into future contracts that include incentives for identification and analysis of deficiencies and corrective actions to prevent their recurrence; and for open communication in reporting of WP&C issues and incorporation of lessons learned into future WP&C.

#### Contractor Management and Line Programs

- Reinforce ISM expectations in their manager's performance evaluation plans and ensure all levels of management are held accountable for their ISM performance.



### Contractor Management

- Ensure that clearly articulated communication steps both between work groups and within work groups are included in WCDs and pre-job briefings.
- Re-emphasize the responsibility for all managers, supervisors, and workers to stop work whenever WCDs are unclear or in contradiction to the observed conditions. Ensure that supervisors and workers are able to practice their stop work authorities and express a questioning attitude without retribution, and recognize these instances as good practices.
- Ensure that employees understand the need for strict adherence to WCDs.



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#### Contractor Management

- Ensure that comprehensive post-job briefings are conducted consistently and that feedback from these briefings is incorporated into future WCDs.
- Assess the effectiveness of their Operating Experience Program as part of self-assessments conducted to evaluate organizational performance in ISM.
- Ensure that each of their sites/facilities is participating in their local and DOE Corporate Lessons Learned Program.
- Ensure properly qualified/staffed teams perform periodic evaluations of WCDs.
- Ensure that corrective actions include effectiveness reviews involving actual observations of work in the field.

#### Contractor Management and Line Programs

- Incorporate DOE line program and contractor oversight of activity-level WP&C into annual integrated assessment schedules.





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#### Contractor Management, Line Programs, and HSS

- Integrate safety culture attributes into assessments of activity-level WP&C to identify organizational weaknesses in WP&C.
- Apply a holistic approach in the analysis and trending of activity-level WP&C performance that includes consideration of results and lessons learned from Accident Investigations, DOE and contractor performance assessments, occurrence reporting, and organizational culture assessments.

#### HSS

- Initiate efforts to improve the lessons learned and operating experience communication systems to enhance cross-site dissemination of activity-level WP&C knowledge and best practices.
- HSS, working collaboratively with DOE Line Programs and EFCOG, should establish an Operating Experience Recognition Program to recognize best practices and performance improvement efforts in the area of WP&C.



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- This analysis identified a recurring set of activity-level WP&C deficiencies.
- An analysis report is under review and will be distributed.
- DOE organizations should use the analysis results contained in the report when reviewing the extent of these deficiencies within their programs and sites; and should consider the associated recommendations when developing corrective actions for continuous improvement.
- DOE should also apply the results from the report in related actions to improve activity-level WP&C.



# Reference Material



ISM Workshop on Activity-level Work Planning and Control (WP&C)

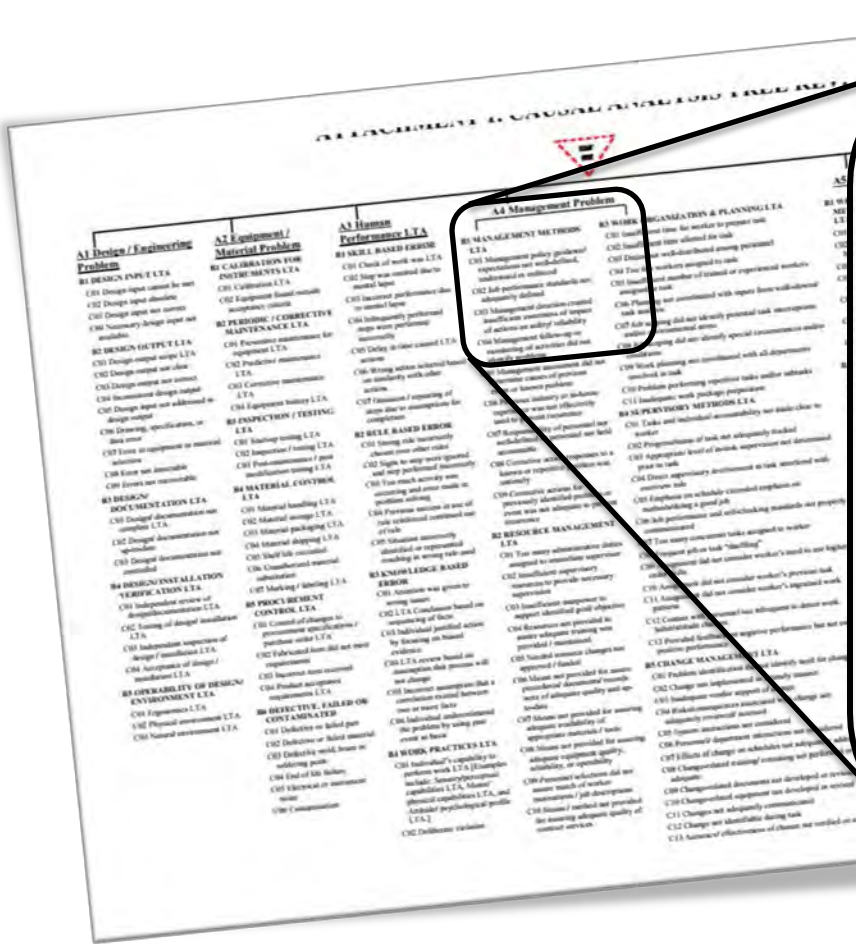
A4 Management Problem

B1 MANAGEMENT METHODS LTA

- C01 Management policy guidance/ expectations not well-defined, understood or enforced
- C02 Job performance standards not adequately defined
- C03 Management direction created insufficient awareness of impact of actions on safety/ reliability
- C04 Management follow-up or monitoring of activities did not identify problems

B3 WORK ORGANIZATION LTA

- C01 Insufficiently defined
- C02 Insufficiently defined
- C03 Duties not clearly defined
- C04 Too few resources assigned to task
- C05 Insufficiently defined
- C06 Planning and control task analysis
- C07 Job scope and/or environment not clearly defined
- C08 Job scope and/or environment not clearly defined

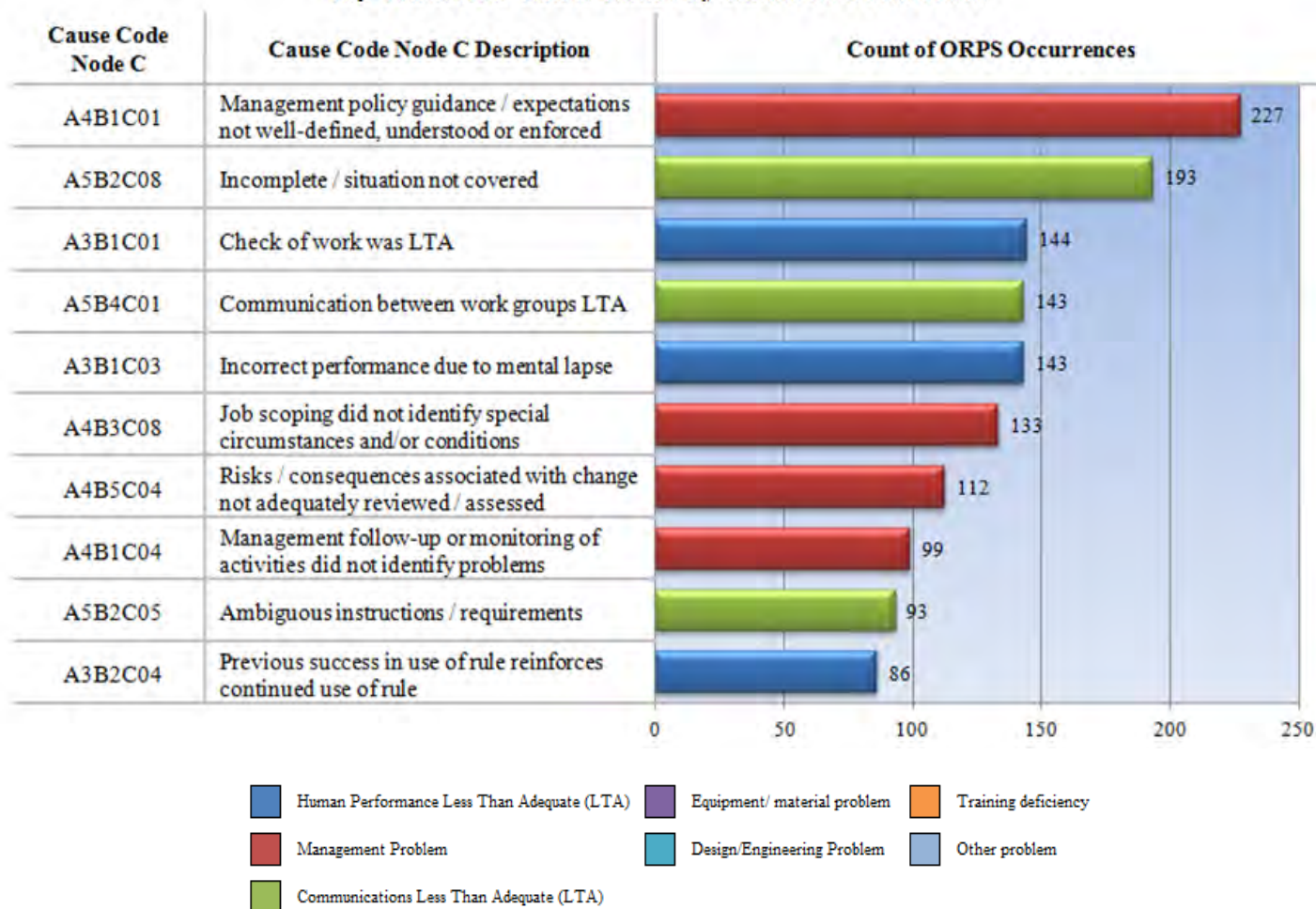






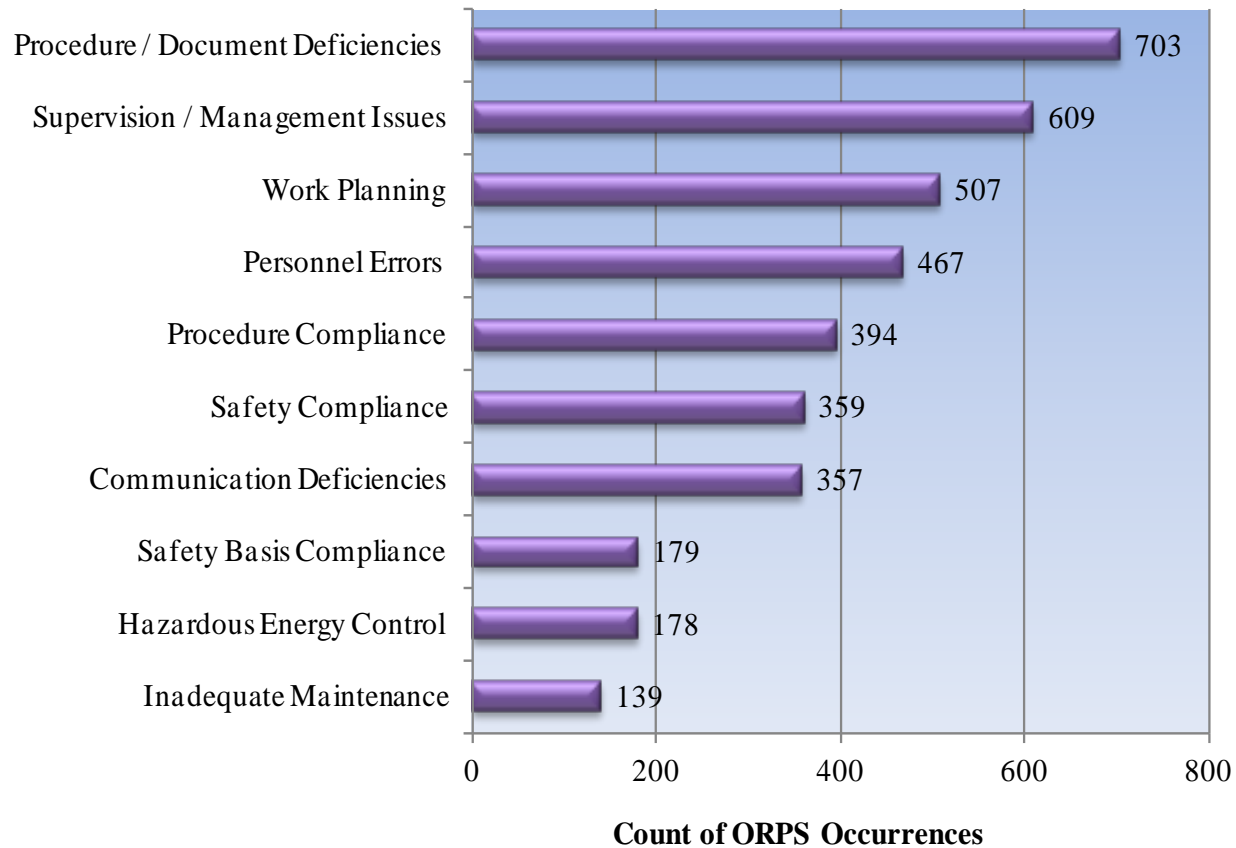
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**Top Ten ORPS Cause Codes by Count of Occurrence**





### Distribution of WP&C Topics by Work Planning and Control HQ Keywords







DOE Defense Nuclear Facility	Number of ORPS Occurrences
Hanford	543
Idaho (Idaho Cleanup Project)	151
Los Alamos National Laboratory	502
Lawrence Livermore National Laboratory	190
Nevada National Security Site	73
Oak Ridge National Laboratory	28
Pantex Plant	253
Sandia National Laboratories	134
Savannah River Site	355
Waste Isolation Pilot Plant	30
Y-12 National Security Site	231
<b>Total</b>	<b>2,490</b>



### ***Worker Sprayed with Scalding Water during a Steam Condensate Line Repair***

This occurrence is an example of Procedure/Document Deficiencies leading to inadequate hazard identification and control.

A pipefitter's abdomen was splashed with scalding water, resulting in a second degree burn while he was tightening a union on a newly installed section of a steam condensate line in an equipment room. Subsequent inspection of the steam condensate line found additional isolation points downstream on a steam trap that had not been identified during the walkdown because of congestion of overhead piping in the area. Due to the age of the building, no "as-built" drawings were available. The congested piping arrangement that hid the steam condensation piping represented an undocumented configuration management problem. Had proper diagrams of the area been available, the workers might have been able to identify the additional hazardous isolation points.



### ***Work Scope Exceeded during Demolition resulting in Worker Contacting Energized Electrical Conductor***

This occurrence highlights the Cause Code pair involving less than adequate management expectations and a lack of communication between work groups.

Workers contacted hazardous electrical energy when they exceeded the demolition scope of the work package to remove a conveyor. At the root of this occurrence was the failure to incorporate all parties in the utilities walkdown of the conveyor and the structures surrounding the conveyor. As a direct result, when the workers exceeded the scope of the work order, they did not understand the consequences, nor did they understand the potential dangers. Further exacerbating the situation was the transfer of supervision from one superintendent to another prior to work beginning, but after the utility walkdown occurred. The lack of written communication left the workers and the new superintendent without points of reference to determine if the work they were performing was, in fact, part of the work package.



### ***HEPA Vacuum Sludge Removal Performed without a Radiation Work Permit***

This occurrence highlights problems with exceeding the scope of work, supervisors not fully understanding the tasks being performed by their workers, the potential for exposure to hazards, and the need for workers to have a questioning attitude.

Subcontractor custodians were cleaning and removing sludge from a wet/dry HEPA vacuum without a radiation work permit (RWP) as required, and the work was not covered under their current Integrated Work Document (IWD). The IWD only addressed the use of the HEPA vacuum, not cleaning it, or that radiological controls needed to be followed to prevent personnel contamination or exposures.

The custodians did not understand or question the limitations of their work tasks or the need for specific radiological controls. There was a lack of understanding of the custodial work tasks amongst many organizations, including the custodians' supervisor and the maintenance coordinator team leader. The full scope of the work should have been evaluated for radiological controls and appropriate PPE in accordance with an approved radiological work permit.



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Observations of WP&C Issues by Key Deficiency Category and ISM Core Function						
Observation	ISM Core Functions					Analysis
	CF1	CF2	CF3	CF4	CF5	
<b>Procedures and Documents</b>						
WCDs that do not communicate the controls in place to prevent accidents or injuries			•			DNFSB/TECH-37
Elimination of potentially confusing step sequence logic, without reliance on a waiver statement or “notes” to compensate for poorly planned work orders			•	•		DOE Docs
Lack of WCD verification and validation			•		•	DOE Docs
Over-reliance on skill-of-the-craft			•	•		DOE Docs
Procedural non-compliance, with work being performed outside of work controls				•		DOE Docs
Procedures that are too broad in scope create the vulnerability that work will be performed outside of the intent of the WCDs, leaving workers to navigate the WCDs with little guidance from generic work instructions	•		•			DOE Docs
Ambiguous (written) instructions/requirements			•			ORPS Cause Codes
Check of work less than adequate				•		ORPS Cause Codes
Previous success in use of rule reinforces continued use of rule			•	•		ORPS Cause Codes
Personnel Errors				•		ORPS Keywords
Procedure and Document Deficiencies	•	•	•			ORPS Keywords
Work Planning Issues	•	•	•		•	ORPS Keywords
Procedures and WCDs did not always provide the best methods for performing work.			•			ORPS Reports



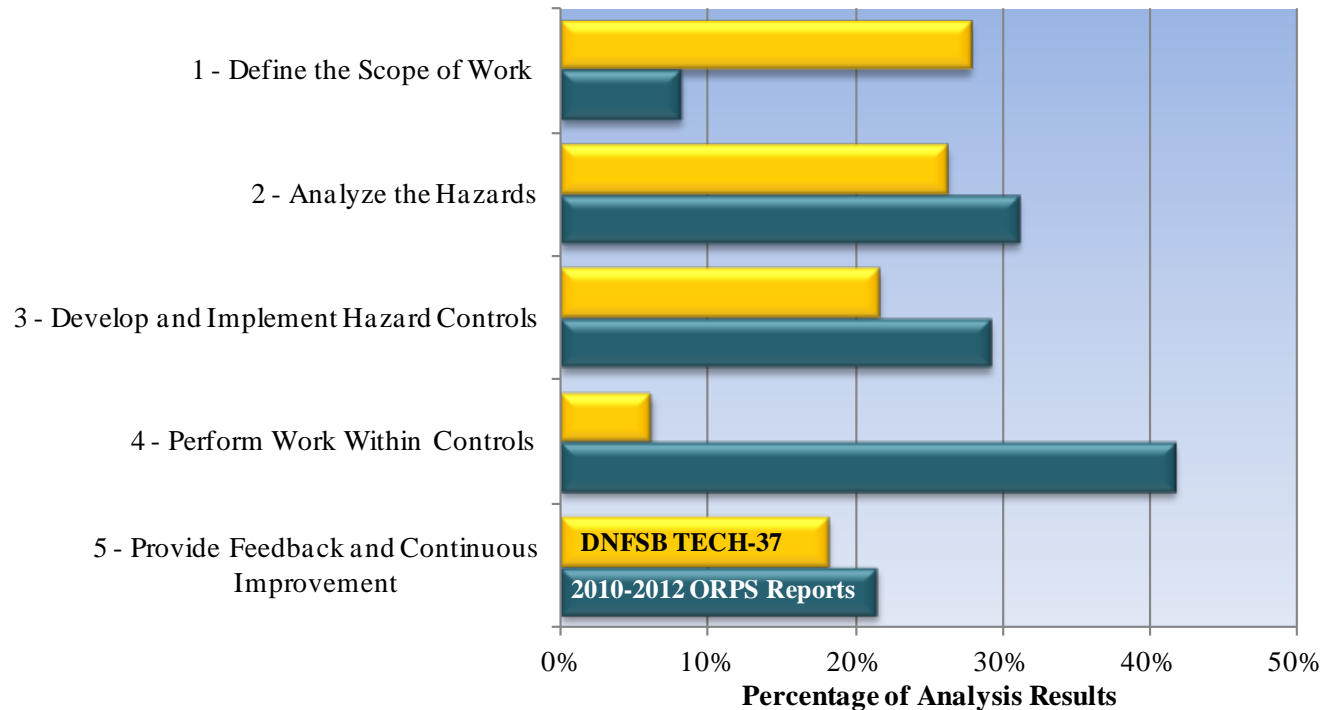
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	DNFSB Staff Review Bullets (Reviews)	DOE AI Causes/ Conclusions	DOE Documents	ORPS Causal Analysis	ORPS Keyword Analysis	ORPS OPEX Summaries	Safety Culture Reviews
Hanford	43(4)	13	4	270	355	6	1
Idaho	10		2	86	110	5	1
LANL	12		2	252	372	12	1
LLNL	12	8	3	91	123	4	
NNSS	13		3	34	40	1	
ORNL				16	15	1	
Pantex	11			99	158	4	1
SNL	12	8		80	85	3	
SRS	27(2)	30(3)		181	196	1	1
WIPP	11	12	1	17	20	3	
Y-12	21(2)		1	110	134	2	1
<b>TOTAL</b>	<b>172</b>	<b>71</b>	<b>16</b>	<b>1,236</b>	<b>1,608</b>	<b>42</b>	<b>6</b>





### HSS ISM Analysis of DNFSB Documents vs. ORPS ISM Analysis\*







A qualitative analysis of HPI was performed to identify human error precursors associated with ORPS occurrences.

The most frequently-cited human error precursors were:

- Imprecise communication habits
- Lack of knowledge
- Unclear goals, roles, or responsibilities
- Interpretation of requirements