



**EFCOG SAFETY SUBGROUP ISM/CAS/QA TASK 3**

**ESTABLISHING A CONSISTENT APPROACH TO ADDRESSING  
IMPROVEMENT IN OPERATIONAL PERFORMANCE**

**WP-SAF-ISM-CAS-QA-001-RA**

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## FOREWORD

This white paper recommends a strategy structured around eight countermeasures (see definition 6.2) to improve formality of operations and its consistent implementation to reduce the likelihood of operational upsets at U.S. Department of Energy (DOE) sites, facilities, and projects. This effort was triggered by National Nuclear Security Administration (NNSA) Performance Objective (PO) 5.5: *Demonstrate improvement in formality and rigor for Organizational Culture in Conduct of Operations through the institutional implementation of effective and efficient countermeasures.*

These recommendations are applicable to Management and Operations (M&O) and Prime Contractors responsible for DOE sites. It is an amalgamation of information from existing programs at several DOE-contracted sites and guidance from DOE and other industries performing complex work of national importance.

This white paper reflects the collective experience of DOE Prime and M&O Contractors. It is intended to be robust and applied according to the hazards and complexity of work activities at a given site. This information should be applied in a graded approach based on the facility approved safety basis and risk ranking for a broad range of nuclear and non-nuclear applications. This guidance, being a compendium of universal good practices, is useful to organizations seeking continuous improvement.

This white paper describes suggested non-mandatory approaches for meeting DOE requirements and directives. This document does not contain requirements and is not to be construed as requirements in any audit or appraisal for compliance with DOE requirements and directives. DOE requirements, directives, and other guidance material have been referenced to provide context.

Contractors are advised to use this document to identify opportunities for improvement within their sites, facilities, and projects. We encourage Contractors and Federal employees to comment on or participate in the Energy Facility Contractors Group (EFCOG) organization to further improve these recommended practices as EFCOG and member contractors strive for excellence in organizational performance. Further information on the Contractor Assurance Systems (CAS) group and participating sub-groups and communities of practice can be obtained from the EFCOG website at <http://www.efcog.org/>. Please direct correspondence to the EFCOG CAS contacts listed at [https://efcog.org/?page\\_id=11488](https://efcog.org/?page_id=11488)

## EXECUTIVE SUMMARY

Purpose: An EFCOG team, utilizing the National Nuclear Security Administration (NNSA) Conduct of Operations A3 Working group evaluation of reported events in NNSA facilities, worked to develop a set of “countermeasures” to mitigate or eliminate “Operational Upsets.” The goal of the team was to provide recommendations for improving performance in mission execution with a focus on:

- Organizational Culture (Enterprise Voice and Presence)
- Improvement Metrics
- Leadership
- Training and Development of a Learning Organization

The driver behind this evaluation was NNSA PO 5.5 (originally 6.5): *Demonstrate leadership in driving enhanced and sustainable formality and rigor of operations through proactive implementation of effective and efficient measures to minimize operational upsets that have potential to impact mission.*

The focus of this document is to provide prevention or mitigation strategies for “Operational Upsets” by building capacity and resiliency into management processes and systems.

Team: EFCOG organized a core team of technical experts to review the NNSA evaluation, conclusions, and recommendations. Overall, there were about 60 contractor participants from across DOE and the contractor community. This included contributions from multiple Working Groups and Task Teams including Contractor Assurance System (CAS), Quality Assurance (QA), Integrated Safety Management Systems (ISMS), Human Performance Improvement (HPI), Safety Culture, Work Planning and Control (WP&C), and other experts in operations activities. The team included a representative from the DOE/NNSA Operations A3 Working Group.

Data Sources: Key NNSA Contractors provided direct insights and presentations to the team. Surveys were developed and conducted across the DOE/NNSA Complex. Nuclear industry publications and documents associated with nuclear performance standards, studies, assessments, and good practices were reviewed and analyzed. The team reviewed current NNSA Contractor initiatives addressing performance expectations. (See Appendix 1 & 2)

Definitions: The definitions of “Operations,” “Conduct of Operations,” “Operational Upsets,” and “Countermeasures” were not consistent or well understood and required clarification to ensure consistent use and interpretation. Mission assurance, while a simple concept to understand, is difficult to practice in a large federal environment with complex regulatory drivers. (See Appendix 1, 2, 3, 5 & 6)

Culture: Organizational culture defects identified included a non-conducive environment to report, screen, and evaluate error-likely conditions, near misses, issues, employee concerns, or events. This can lead to missing corrective or preventative actions that could mitigate or prevent significant disruption to “Mission Delivery.” Operations as used in this document covers a broader context than operations identified in DOE Order 422.1. (See Appendix 3)

Organizational Structure: The structure of the organization may present many performance challenges to mission success due to the inherent complexity, diversity, and cross-purpose of priorities related to structure, function, safety requirements, projects, research, oversight, or regulatory roles. Organization or project drift, new technologies, changing business systems and remote workers all challenge the culture and can affect overall performance. Management and Administrative Control systems are limited in effectiveness by Human Performance or systems failures. (See Appendix 4)

Environment: While the physics and science may be constant, the work environment experiences changing conditions in scope, regulations, or customer requirements that can cause unintended transients that make it difficult to plan, manage, or maintain performance expectations, much less improve them. Market conditions, employee retirements, job changes, project transitions, contractor transitions, and changing roles all increase risks to performance or stimulate potential negative performance impacts. (See Appendix 4)

Recommendations: This document recommends a strategy focused on eight countermeasures designed to improve rigor and formality of operations, while also reducing the likelihood of “Operational Upsets.” (See definition 6.2.) It provides guidance on establishing a consistent approach to addressing improvement in operational performance by minimizing operational upsets. This white paper also highlights successful practices implemented at various DOE/NNSA organizations and identifies valuable references and resources. Collectively, this document provides a roadmap for effectively addressing operational upsets by providing a set of eight countermeasures that can be used to support successful mission performance. These eight countermeasures, discussed in detail in the body of this document, focus on leadership, organization, and human opportunities to address challenges for performance improvement.

1. Leadership Engagement and Ownership
2. Implementation of an Integrated Management Systems Model
3. Supervisor (Front Line Manager) Involvement
4. Workforce Onboarding, Retention, and Proficiency
5. A Learning Organization and Psychological Safety
6. Issues Management
7. Risk Management
8. Effective Measuring, Monitoring, and Oversight for Improvement

Performance Improvement can start with a systematic plan that is structured to drive continuous improvement and provide a mechanism for maintaining a high level of performance without impacting the mission. The plan should factor in organizational culture, mission, safety culture and work environment, metrics, supervisory involvement, training, and development of a learning organization.

## PURPOSE

The goal of this white paper is to aid EFCOG contractors in developing and maintaining a consistent approach to addressing NNSA Performance Objective (PO) 5.5 which states:

*Demonstrate improvement in formality and rigor for Organizational Culture in Conduct of Operations through the institutional implementation of effective and efficient countermeasures.*

A consistent approach to achieving PO 5.5 will aid in the identification and mitigation of conditions and precursors to potential “Operational Upsets.”

### Conduct of Operations

The purpose of DOE Order 422.1, *Conduct of Operations* is to ensure that management systems are designed to anticipate and/or mitigate the consequences of human fallibility or potential latent conditions and to provide a vital barrier to prevent injury, environmental impact, or asset damage, and ensure mission success. For this white paper, Conduct of Operations (CONOPS) is used in a broader context to cover a suite of operations beyond applicability identified in DOE Order 422.1 (i.e., nuclear facilities). The terms conduct of operations, formality of operations, and disciplined operations are used interchangeably throughout this white paper.

The term “operations” encompasses the work activities of any facility or organization. This includes, but is not limited to, building infrastructure, shop areas, computer centers, scientific research, construction activities, and nuclear facilities operations. It is critical to recognize that “Operational Upsets” can originate in all areas of the enterprise.

## BACKGROUND/SCOPE

In September of 2011, DOE issued document 450.4-1C Attachment 10 which identifies behaviors that, when demonstrated consistently, promote a positive safety culture. (See Appendix 3 for ties to Organization and Safety Culture.) This changed the focus for avoiding operational upsets from prescriptive interventions to performance objectives. This document promoted a shift from compliance towards a standard of operational excellence with an emphasis on continuous improvement and long-term performance.

In 2021, the NNSA Conduct of Operations A3 Working Group (Working Group) performed a Toyota A3 Process Review of events within NNSA facilities reported in the DOE’s Occurrence Reporting and Processing System (ORPS) database for a ten-year span (2011-2021). The Working Group reported that within the ten-year timeframe examined, reportable events at enterprise sites resulted in lost mission work hours due to poor performance of operations (Reference 5.1). Besides the direct loss of productive mission hours, other significant resources were expended on investigation, response actions, and retraining. The Working Group found that the number of events over the ten-year period analyzed remained static. The Working Group’s data revealed that the NNSA enterprise experienced an average of 173 “conduct of operations” related occurrences annually, with 71 such events resulting in work pauses each year. It was observed that corrective action plans were developed and executed



for these events, but the event data suggest the corrective action plans were not effective in reducing the number of operational upsets.

The goal is to embed Leadership, Worker Engagement and Organization Learning concepts into the Department's DNA – so it becomes part of everything we do -- in **every task**, with **every person**, **every day**. However, for the purpose of this paper we will focus on Organizational Culture as it relates to the Performance Evaluation Measurement Plan (PEMP) directive.

### ***Methodology***

Upon receiving feedback from the NNSA Conduct of Operations A3 Working group, this white paper task team took steps to confirm the identified existing issues and needed improvements. Several NNSA Contractors (EFCOG members) shared their current practices and ongoing efforts to address the performance expectations of PO 5.5. A review of successful practices occurring both internal and external to the DOE/NNSA Complex was explored (see Appendix 1). The Task Team then developed and distributed a DOE/NNSA member survey to further query current performance, successful practices, and ongoing challenges that contribute to operational upsets. These efforts resulted in the identification of eight countermeasures to improve rigor and formality of operations.

### ***Challenges***

Countermeasures are needed because of the myriad of mission-work challenges facing the DOE/NNSA complex. By acknowledging the challenges, organizations can take direct and purposeful actions to address them.

Challenges to achieving PO 5.5 were identified through the following mechanisms: 1) EFCOG member organizations self-identified their organizational challenges derived from their site-specific performance data, keeping in mind NNSA Working Group findings addressed above; and 2) EFCOG member organizations submitted responses to an internal EFCOG survey, which the task team compiled and categorized.

Many sites share challenges, despite the variety of businesses, technological industries, work performed, and hazards that exist throughout the NNSA/DOE complex. In large part, these challenges are well documented, along with good practices available to mitigate these events.<sup>1</sup>

The information and data shared by EFCOG members confirmed that senior leadership is committed to substantive and sustainable process improvements in the organization and have developed enterprise level strategy plans specifically to improve operational performance. Most NNSA Contractors address PO 5.5 with formality, rigor, and a validated approach to provide sustained countermeasures and deliberate measuring and monitoring methods to track overall performance. NNSA contractors addressing PO 5.5 at an institutional level are currently in the process of implementing new or updated initiatives as part of an overall continual improvement effort. Most sites have established networks to benchmark and learn from each other, understanding the value and role each Contractor plays in the National Security Enterprise. Where appropriate, the information shared via presentations and surveys will be highlighted throughout this paper.

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<sup>1</sup> Two examples are the DNFSB April 10-2022 report on CAS Effectiveness, and DOE-EA Report 2017 on Improving Disciplined Operations. See also Appendix 1 and 2.



Concerted effort was made by the task team to identify consistent criteria for enhancing formality of operations to reduce the likelihood of operational upsets that could be tailored and implemented at each NNSA Contractor's site, despite current culture state and variability in portfolio responsibilities. As there are different levels of maturity in the various organizations, a suite of approaches has been depicted to support a maturation process for the complex.

One key opportunity in performance improvement is to glean insights from a review of organizational and functional initiatives implemented by other similar organizations performing high risk operations outside the DOE/NNSA community, such as taking a closer look at The Nuclear Regulatory Commission (NRC), the Institute of Nuclear Power Operations (INPO), the National Administration for Space Agency (NASA), and other institutions with nuclear and high reliability facilities and organizations, which can provide useful ideas or insights. Appendices 1, 2 and 3 provide examples of best uses of such information.

INPO provides an operational expert resource base that peer checks and supports common approaches in the Commercial Operation Nuclear Units and a different approach to benchmarking and peer review, which might be customized for DOE/NNSA. This could be addressed by DNFSB, and DOE/NNSA and Contractors, even though DOE/NNSA is a self-regulating structure.

## **NARRATIVE**

### **Countermeasure 1: Leadership Engagement and Ownership**

To increase rigor and reduce the likelihood of operational upsets, leaders should be engaged and take ownership over the role they play in creating a resilient organization. This is accomplished through building an organizational culture whereby leadership actively and visibly supports the seven other countermeasures.

Effective leadership is one of the three focus areas highlighted in DOE G 450.4-1C, Integrated Safety Management Guide Attachment 10, *Safety Culture Focus Areas, and Associated Attributes*. The actions and behaviors of managers demonstrate their commitment to safety and organizational performance success. This can be shown by conducting walk-throughs, personal visits, and verifying that their expectations are met. Effective managers clearly identify production and safety goals to ensure the workforce understands the behaviors and actions expected of them by their leaders. Managers are systematic and rigorous in making informed decisions that support safe, reliable operations, and support their employees' approach to unexpected or uncertain conditions. These behaviors ensure risks are appropriately managed and work can be successfully completed, reducing the likelihood of downturn from operational upsets.

### ***Challenges to Implementation***

There are many challenges around leadership engagement and ownership that create barriers to achieving successful operational performance. These can include an overreaction or over prescribing actions for improvements, ineffective change management, and lack of engagement with workers. Additional challenges are listed below:

- Culture: Despite best intentions, silos remain that inhibit effective leadership integration across organizations to promote one common purpose. This results in leadership focusing on their direct organizational span of control and not working across organizations to promote effective

integration of processes and systems. Various “cultures within cultures” arise due to a lack of teamwork and a shared vision when groups do not work collectively towards a common goal (i.e., one team mentality). As events and failures occur, improvements are made in silos, without a complex-wide, system approach. There is a failure to hold people accountable to a unified direction, often rewarding divergent and redundant initiatives. This contributes to a less integrated approach to support successful mission execution.

- **Direction for Improvement Initiatives:** Complex-wide initiatives for operational performance improvements have had limited impact due to a lack of direction for improvement, manifesting as a lack of clear expectations from leadership. A lack of formality of expectations leads to inconsistent implementation.
- **Framework:** Lack of a complex-level approach or established organizational framework results in multiple and competing assurance sub-processes that create inefficiencies for mission execution.
- **Metrics:** There is no agreement of what success looks like or what to measure, or leadership is not leveraging metrics to improve performance.
- **Organizational Learning:** There is a lack of transparency and shared meaningful lessons learned across organizations and within the DOE complex resulting in repeated mistakes and errors that could have been avoided.
- **Ownership:** Lack of formality of operations/lack of integration is consistently identified as either the cause or contributor to many issues.
- **Senior Management/Stakeholder Engagement:** Lack of field engagement by leaders leaves a gap in the ability to learn first-hand where opportunities for improvement exist in normal work execution. Mission enablement processes/systems lack adequate stakeholder engagement to drive effective mission execution and assurance.

DOE/NNSA members were asked to participate in an EFCOG CAS Survey and identify their site’s current and most significant challenge to effective CAS implementation. The survey responses revealed several challenges concerning leadership engagement and ownership, including a lack of leadership support and commitment and a prevailing “old guard” resistance to change (i.e., we’ve always done it this way) and leadership that is nearly inaccessible; where all information is filtered through gatekeepers adverse to making decisions or delivering unpleasant news. Respondents indicated difficulty in getting senior management to prioritize CAS efforts and an overall lack of leadership engagement.

Leaders should foster an environment that is built on trust, accountability, transparency, integrity, and respect, ensuring that these values are maintained through all organizational levels via increased communication, transparency, and integration of the overall organization or project.

Leaders play an integral role in establishing effective partnering among all team members, contractors, and customers, including NNSA. Behaviors and actions that support these values include:

- **Timely Communication:** The contractor communicates pertinent operational information to NNSA in an expeditious manner.
- **Transparency:** The contractor makes pertinent operational information and activities readily available and, therefore, transparent to DOE.
- **Continuous Feedback:** The contractor is open to feedback from NNSA and acts to improve performance.
- **Trust:** NNSA has confidence in the credibility and constructiveness of the contractor's effort.

These actions and behaviors give NNSA confidence in the contractor's credibility and constructiveness of effort, as well as build a stronger partnership between the contractor and NNSA, as opposed to a less desirable transactional governance model.

### ***Focused Improvement Opportunities***

A critical countermeasure to achieve safety and mission performance success includes leadership, ownership, sponsorship, and engagement with cascading communication and feedback from the executive team through "hands on working teams."

Executive leadership teams need to effectively integrate contractor leadership, project/organization, business-management, contractor governance, project management and DOE oversight systems into a single, comprehensive performance management system to assure responsiveness to contractor assurance requirements and to assure that the mission is clearly defined, understood, communicated, and monitored throughout the organization.

Establishing effective governance, performance, and oversight teams with trust-based communication processes among executives, leadership teams, and partnering with the customer is critical. Leadership should be tied directly to a senior management position of authority and overall performance responsibility to affect the ongoing continuous improvement expected. The leadership role should be implemented and supported by a structured organization team directly engaged with activities key to define and communicate performance expectations and mission success.

Engagement of the workforce and valuing worker input at every level is necessary to understand challenges of performing everyday work. It is important to clearly communicate values, requirements, priorities, performance expectations, and clarity of the mission objectives. Extra effort is required to fully integrate and comply with the massive suite of regulations, standards, orders, guidance, handbooks, and customer expectations. These often require extensive collaboration and coordination with multiple customer interpretations and priorities.

(See References 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.10, 5.11, 5.12, 5.20)

### **Countermeasure 2: Implementation of an Integrated Management Systems Model**

Overwhelming feedback from NNSA members noted the importance of robust integration of a site's management systems. As previously stated, organizations often develop management systems in silos, and this can lead to conflicting requirements, priorities, and practices. Per DOE G 450.4-1C, it is advantageous to discuss and integrate various management systems (e.g., ISM, CAS, Quality, Financial, Project Management, etc.) into one integrated management system to eliminate redundancy and strengthen the overall implementation of the systems as an integrated management system.

Stakeholders should provide further direction and guidance to Contractors on how to integrate management systems effectively. To drive a culturally integrated holistic approach, management systems requirements and expectations need to be fully integrated, to the extent practical. An integrated management system aims to avoid silos by combining all systems and processes into one complete framework, enabling an organization to work as a single unit with unified objectives. This improves efficiency and regulatory compliance, ensuring that safety and security issues are given high priority in decision-making. Integrating management systems can also lead to cost savings and efficient utilization of resources within an organization. Achieving cogent, clear, and consistent messaging of an organization's values is vital if the organization wants to see organizational performance improvement. When performance improvement initiatives are not effectively integrated throughout the organization, the initiatives' results are weaker. Silos spur diverse cultural subgroups with different drivers, objectives, and priorities.

Culture should support an integrated holistic approach. Organizational culture is the totality of the cultural aspects of the organization (e.g., safety culture, ethics and compliance culture, CONOPS, Ops, HPI, DEI, etc.) and the dynamic way in which these aspects of culture interact and co-exist. An integrated approach at the organizational culture level will ensure an integrated approach at the systems level.

Many federal and general industry organizations are shifting to adoption of a "safety management system" model, recognizing that successfully integrating management systems can have several tangible benefits for an organization, including:

- Avoiding duplication of effort
- Making more effective use of senior management time
- Using resources to implement and manage systems in a more efficient manner
- Achieving more cost-efficient certification
- Reducing audit fatigue

### ***Challenges to Implementation***

As noted already, the current Defense Nuclear Facilities Safety Board (DNFSB) and DOE/NNSA recommendations and commitments are made to address the concerns related to effectiveness of the CAS Process as well as performance concerns. There are many challenges in this initiative due to inherent DOE/NNSA complexity reflected in the multitude of organizations, functions, nuclear safety requirements, types of projects, research, and diversity of internal and external oversight and regulatory roles.

Initiatives for improving performance should be integrated with the well-established existing processes as required by applicable regulations and requirements of DOE/NNSA. Policies, Orders, Guides and Handbooks adequately cover CONOPS, Integrated Safety Management (ISMS), CAS, Quality Assurance (QA) as well as many other regulations and requirements. Therefore, it seems prudent to assess the overall regulatory, management, oversight, and support systems currently in place and what needs to be done for overall improvement.

There are overlapping portions of CONOPS, ISMS, CAS, Environmental Health, and Safety (EHS) and QA based on separate regulatory Orders, program guidance, and handbooks. Each of these flow down processes, procedures, and in some cases, instructions. While there may be some intentional overlapping requirements, implementation of these requirements by various functional areas may result

in inefficient and duplicative processes. This leads to confusion within the workforce with no perceived overall benefit. (See EFCOG WP-SAF-ISM-CAS-002-R0 White Paper Review of Hanford's ICAS)

With pressures from the federal government to go faster and achieve more, and with management and staff providing feedback that excessive bureaucracy is a key factor impacting workforce retention, DOE/NNSA contractors recognize the need to revisit management system principles, take informed risk, and cut red tape. The immediate impacts of excessive bureaucracy include reduced employee motivation to complete fulfilling work, reduced manager capacity to engage and lead staff, inefficient use of resources, and increased frustration that eventually impacts morale, engagement, and retention.

A renewed leadership focus on eliminating bureaucracy calls for better and more effective ways of identifying an organization's biggest pain points and celebrating wins. Organizations can improve employee morale and retention and reduce red tape through initiatives, but sustainment requires principles that are embedded in the organization's culture, strategy, governance, and incentive structures. Reduction of bureaucracy should additionally be communicated and consistently modeled by leadership. Organizations should review and simplify their current management system state to ensure intentional design and outcomes on assurance objectives (i.e., safety, security, quality, etc.). This includes an evaluation of existing charters for meetings, boards, or committees in place, and maintaining alignment on overall objectives and overall risk posture across the various lines of work and vectors of assurance.

### ***Focused Improvement Opportunities***

Starting with a formal and informal mutual understanding of the requirements and stakeholder performance expectations, the following improvement opportunities should be considered to strengthen the integration of an Integrated Management System Model:

- Take time to establish and communicate an integrated Project Management, or Organizational Operational Plan that addresses and integrates all the necessary management systems and approval basis, including both corporate and client expectations.
- Systematically streamline the management systems, including all oversight and support organization systems, to eliminate duplicate and overlapping requirement interpretation.
- Establish an agreed upon risk-based graded approach via a unified integrated management system model integrating safety, security, quality, and overall CAS.
- Avoid allowing multiple support and oversight processes in building complex or redundant processes or systems.
- Focus on effective and efficient processes; avoid overprescribing or providing conflicting requirements that do not add value in balancing risk with mission execution.

(See References 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 5.9, 5.19, 5.21, 5.27, 5.29, 5.30)

### **Countermeasure 3: Supervisor (Front Line Manager) Involvement**

The Supervisor and/or First Line Manager (FLM) is a critical component to achieving improvements in CONOPS formality and rigor. As the conduit between senior leadership and the workforce, FLMs are needed to be in the field effectively leading, coaching, and actively shaping organizational culture and performance expectations. As DOE G 450.4-1C, Integrated Safety Management Guide, Attachment 10,

*Safety Culture Focus Areas and Associated Attributes* states, maintaining operational awareness is a priority, and that is achieved through line managers in close contact with front-line employees. FLMs should practice visible leadership and set an example through their own behaviors, role modeling healthy inquiry and critical thinking to ensure that work-as-planned aligns with work-as-performed. Effective FLMs encourage discussion when gaps are identified and take action to narrow those gaps in collaboration with their employees.

### ***Challenges to Implementation***

The FLMs operate in a complex environment with many administrative processes and requirements that challenge their capacity to perform these critical roles. Concurrently, FLMs may lack managerial experience. Next to workers that perform everyday work, FLMs are a critical line of defense to achieve successful outcomes.

FLMs and others with supervisory roles normally have many demands on their time in addition to supervising the actual work. This includes planning, communication, coordination, and interaction, meetings, providing data and information, training, administration, answering questions, and substituting for their leaders, etc. They may or may not have participated in the work planning activity. One contractor identified that 40 percent of the supervisory staff had two years or less of hands-on experience. This is a paradigm shift from previous norms of supervisors coming up the ranks with a wealth of knowledge and experience from working in the same area over many years.

### ***Focused Improvement Opportunities***

**Coaching and Mentoring:** Coaching and mentoring employees with independent and experienced people should be considered. A focus on the FLMs is prudent and should be a part of an organization's leadership development strategy. FLMs are the interface between the hands-on worker and management and often receive training but seldom in coaching/mentoring during the actual implementation of leadership principles. Independent coaches/mentors with leadership and technical experience are invaluable and can provide the objectivity for day-to-day demands. They can also provide guidance to workers and middle level management at the same time. For this approach to work, selection of coaches/mentors equipped with the appropriate emotional intelligence skillset is essential to create a psychologically safe environment where information is freely shared throughout the organization to promote innovation and creativity; improve communications; and promote learning.

**High Reliability Organization (HRO):** To maintain high levels of performance, the principles and strategies of an HRO will need to be embraced at all levels of the organization. This is especially needed to build capacity and resilience in an ever changing, heavily regulated work environment. The term "high reliability" describes an organizational culture that strives to achieve exceptional performance and safety in every procedure, every time — all while operating in complex, high-risk or hazardous environments. An HRO is an organization with predictable and repeatable systems that support consistent operations while catching and correcting potentially catastrophic errors before they happen. Five principles of a HRO include (Weick and Sutcliffe):

- Preoccupation with Failure
- Reluctance to Simplify
- Sensitivity to Operations
- Deference to Expertise
- Commitment to Resilience



Core elements of excellence in performance improvement efforts include:

- Leadership and oversight
- Knowledge and skills
- Culture

For additional information on HROs, see Appendix 4.

Human performance improvement requires a full-scale effort across an organization and consistent reinforcement to embed these principles and practices, so they become part of one's organizational culture. Traditional safety management practices are built on the assumption that human behavior is rational and occurs primarily through conscious decision-making (i.e., error is a choice versus a mistake – an unintended consequence). Making mistakes is normal. People don't choose to make a mistake or error. What is necessary is to build resilient systems that can fail safely.

A critical first step for those wanting to move beyond traditional safety management practices is to recognize employees are the solution and not the problem.

**Performance Monitoring:** Performance monitoring, analyzing, identifying, and planning solutions, and implementing those solutions are critical parts of a performance improvement plan. Those implementing solutions drive performance improvement results via organizational accountability, management oversight/reinforcement, adequate resource management, task assignments, and action tracking.

Poor operational performance is a layered and complex issue with no single answer. Poor operational performance is typically masked by latent systemic conditions that become active undesired conditions or outcomes over time if not properly identified and managed. The Disciplined Operations Work Model defines three “legs” that support successful operational performance: Formal robust process (e.g., procedures/technical work documents), training and experience, and supervision. This model recognizes that risk is dynamic in everyday work and, at any one time, the balance of these “legs” can change, requiring adjustments to reduce risk and drive successful outcomes.

(See References 5.2., 5.7, 5.8, 5.9, 5.12, 5.16, 5.29)

#### **Countermeasure 4: Workforce Onboarding, Proficiency and Retention**

DOE/NNSA personnel are critical to mission success. As such, investment in them is necessary and vital. Yet, maintaining a proficient, skilled, and knowledgeable workforce remains one of the largest challenges facing DOE/NNSA sites. Creating an organizational culture that values the workers and readies them to perform work is a key countermeasure for reducing operational upsets. Embedding the importance of rigor and formality at the worksite, in addition to investing in the workforce's development, are necessary endeavors.

#### ***Challenges to Implementation***

Rapidly changing conditions cause organizational or project transients that make it difficult to plan, manage, and maintain performance expectations, much less improve them. Marketplace conditions, managerial and employee retirements, job changes, new or changing roles, all increase risks to expected performance. Project transitions, new assignments, operating contract changes, and constant changing requirements stimulate potential unintended negative performance impacts. Organization and



project drift, new technologies, changing business and information systems and the impact of access to remote workers all challenge the culture and overall performance of an organization.

The impact of the COVID-19 pandemic and post COVID behaviors multiply the normal difficulty of recruiting and maintaining an experience base for a highly skilled work force. The decline of the commercial nuclear industry is contributing to the reduction of formerly available new talent.

### ***Focused Improvement Opportunities***

- **Comprehensive training approach:** To address the complex needs of workforce onboarding, job proficiency and employee retention, a formal and focused approach should be adopted. The plan should begin by reviewing current training sources within DOE/NNSA (including contractors) to identify gaps and areas of improvement. Additional access to the best available training materials should be developed and multiple approaches to communicate and distribute materials should be established to ensure effective knowledge dissemination.
- **Customized training solutions:** Recognizing the significance of individual user needs for training, the plan should prioritize customized employee training to drive the sources for existing and new training materials available from DOE/NNSA, contractors, and other industry sources by tailoring training to meet specific requirements. Employees will gain relevant skills and knowledge to excel in their roles, fostering job proficiency and satisfaction.
- **Collaborative partnerships:** The plan will foster collaboration with local trades, colleges, universities, and businesses to establish educational programs that prepare individuals to enter the workforce rather rapidly and adequately equipped. By nurturing partnerships, organizations can tap into a pool of well-prepared individuals, addressing both immediate and long-term workforce needs.
- **Innovative training approaches:** The plan should recognize the need for innovative training methods to address the challenges of retention and job proficiency. This includes implementing web-based training that is dynamic, interactive, and engaging. Taking inspiration from game theory and human behavior, the plan should explore gamified training approaches, such as interactive training games to make learning more enjoyable.
- **Mentoring and coaching:** The plan should provide for continuous support and coaching to employees throughout their career journey. It is critical that the initial and ongoing technical, self-directed, and cultural perspectives be integrated into training, for nuclear and high reliability, critical research. Additionally, established worker owned safety teams, teamwork, mutual respect, participation and work planning, and mindfulness of hazards and controls, will ensure a safe and efficient work environment to enhance job proficiency and knowledge transfer. Positions like work control planners and procedure writers should undergo mentorship programs. Under the guidance of experienced and fully qualified peers, interactive coaching and mentoring practices can be employed to ensure employee growth and development.
- **Succession planning:** Succession planning is the process of identifying the critical positions within your organization and developing action plans for individuals to assume those positions. Taking a holistic view of current and future goals, this type of preparation ensures that you have the right people in the right jobs today and in the years to come. When succession planning, the time frame required to recruit, hire and on-board proficient replacements needs to be considered. In the long term, succession planning strengthens the overall capability of the organization by:
  - Identifying critical positions and highlighting potential vacancies
  - Selecting key competencies and skills necessary for business continuity
  - Focusing on development of individuals to meet future business needs

Succession planning is a contingency plan. It is not a one-time event. Succession Plans should be reevaluated and updated annually or as changes dictate within the organization.

- **Worker Portability:** Create a workforce equipped with necessary skills, knowledge, and motivation to excel in their roles. It should not only address current workforce challenges but also establish a strong foundation for sustained success and growth in the long term. Like positions that perform high risk work, work control planner and procedure writer qualifications could also include tutelage of an experienced and fully qualified peer. This provides coaching and mentoring to ensure adequate experience.
- **Human resources:** Personnel with adequate experience, training, and proficiency are needed.

(See References 5.6, 5.7, 5.8, 5.9, 5.15, 5.16, 5.27, 5.33, 5.34)

### **Countermeasure 5: A Learning Organization and Psychological Safety**

Psychological safety is the belief that you won't be punished or humiliated for speaking up with ideas, questions, concerns, or mistakes. It's a shared belief held by members of a team that others on the team will not embarrass, reject, or punish you for speaking up. When psychological safety is present in an organization, employees feel comfortable being themselves. They are bringing their full selves to work, which maximizes their ability to contribute positively to the organization.

To increase resiliency against operational upsets, sites should build and support a learning culture within a psychologically safe environment where screening for and reporting error-likely conditions, near misses, issues, or events is an expected and accepted part of the culture. This information is used to identify, prioritize, track, learn, and provide corrective and preventative actions that will reduce operational upsets.

The most effective type of organizational learning is *“operational learning – understanding the work from the perspective of the worker. The end goal of operational learning is to work together (planner and worker) to:*

1. *Get a more holistic view of how our processes are working,*
2. *Remove unacceptable goal conflicts,*
3. *Reduce known error traps,*
4. *Expand on what helps create success,*
5. *Build stronger and more sustainable defenses to improve the reliability and resilience of operations.”*

(Bob's Guide to Operational Learning Including: A Pocket Guide to the Learning Team Process, 2020)

An organization cannot have effective learning without open engagement with their workforce. Those closest to the work are best equipped to understand the challenges and barriers to meeting mission delivery expectations. They are the solution to driving improvements through organizational learning. Concepts like psychological safety and Safety Conscious Working Environment (SCWE) should be developed, encouraged, and supported. Established DOE National Training Center courses can support building a consistent terminology and establishing an approach/methodology to foster these work environments.

To further understand the impact of organizational learning on an organization's successful CONOPS, there needs to be a working understanding of the characteristics of a learning organization, systems thinking, personal mastery, mental models, shared vision, and team learning.

Systems thinking – a learning organization learns at all levels. Systems thinking begins with learning at the individual level then moves to the team level, and then to the organizational division level and beyond to the complex. In systems thinking, the human is an ecosystem in and of themselves, who interacts with other systems. The larger system is created by creating relationships between individual ecosystems into larger team systems and then into working systems, as divisions and complexes.

It is important to understand that when looking at systems from a macrolevel, every system impacts another system. If we build learning organizations that only focus on a business unit or a team or individual, then we lose the overall benefits to the larger organizational complex.

### ***Challenges to Implementation***

Focusing myopically on mission may unintentionally hinder organizational learning. There is a tendency to identify immediate problems/symptoms, correct, and move mission work forward. However, without diving deeper into the underlying issues to identify and understand systemic causes and using that information to drive substantial, organizational improvements to systems and practices, the organization is at risk of experiencing repetitive problems and additional upsets.

Application of lessons learned in real and substantial ways when planning work continues to challenge NNSA organizations. Siloed work groups often do not broadly share lesson learned databases due to technical and security concerns, without recognizing the importance of the underlying system failures that may exist across work groups, despite common work being performed. Actions resulting from analysis efforts do not always get shared across work groups to ensure that system gaps are filled across the complex. Reviewing lessons learned during work planning and at the “ground floor” using HPI principles embedded in activity level hazard analyses, pre-job and post-job briefs, and after-action reviews are not always occurring or utilized to promote critical thinking prior to and during work execution.

Personnel do not always feel psychologically safe to come forward with problems or concerns. This is often a reflection on how leadership has traditionally responded or reacted to problems and concerns brought forth. Some common reasons why workers do not report or bring forth problems or concerns include:

- Leadership behaviors – specifically how leaders react and respond to problems and concerns.
- Fear of discipline, retaliation, or harsh accountability.
- Previously reported concerns/issues were not acted upon by leadership.
- Normalization of deviance or organizational drift.
- Leadership added additional “controls” to attempt to address problems, without worker input, that in fact add more difficulty or administrative burden to performing successful work.

### ***Focused Improvement Opportunities***

Organizational learning is derived through a variety of means, including but not limited to performance-based assessments, issues management processes, issue/event data and trend analysis, after-action reviews, surveys, and documenting successful work outcomes. An organization achieves improvement

in mission execution through the development and implementation of robust programs that support these activities and proactively seeking ways to get the right information to the right audiences.

## Operational Learning Teams

A Learning Team is one method of Operational Learning. The Learning Team Process is designed to build psychological safety. We want those closest to the work to feel comfortable explaining what work *really* looks like in the field (including all the ugly parts).

- A Learning Team brings together a small group of people to have a discussion.
- The tone of the discussion is conversational (picture chatting at a BBQ).
- A Learning Team looks at the overall system health, not just a specific event or concern.
- A Learning Team is not meant as a “fact finding” mission to discover cause, it is meant to look at complex coupling of normal variability.
- A Learning Team intentionally creates space and desire to hear a story; a messy story, the story of work.

Learning Teams Provide:

- A deeper, context-rich understanding of work (this is the primary goal).
- Areas for action (aka defined problem statements) that can be shared widely to brainstorm ideas on how to improve.
- Team-owned ideas to improve in the areas of action. We are not asking the team to find “perfect” solutions. We are requesting their help brainstorming and executing ideas to improve.
- Restoration and healing for the organization or employees (being part of the solution is powerful).
- A tangible way to demonstrate the power of Human and Organizational Performance (HOP – successor to HPI) principles in action by showing what HOP looks like in practice.

(Bob’s Guide to Operational Learning Including: A Pocket Guide to the Learning Team Process, 2020)

Organizational learning is happening when:

- Programs, processes, and response to outputs are evaluated and improvements are made as necessary.
- Events are used to identify cross-cutting organizational system-level learning opportunities.
- The results of assessments are used to drive impactful improvements (e.g., risk reduction, process efficiencies and effectiveness).
- Management effectively sets priorities and manages risks using the results of a robust issues management system.
- Organizational trends are identified, examined, communicated, addressed, and continually monitored.
- The organization seeks to learn from others through effective lessons learned processes and through the behavior principle of “learning never stops” (operating experiences, lessons learned, benchmarking, etc.).
- Assessments, management observations, performance monitoring, and other performance assurance processes regularly find and address significant issues internally before they become consequential events.

- The principles of HOP, and the sciences behind human behavior and variability, are embraced and incorporated proactively in work planning and reactively into issues/event analyses efforts to identify system-level opportunities for improvement.
- Senior leadership oversight (e.g., management review boards or corrective action review boards) and effective integrated assessment approaches are viewed and treated as critical to organizational success and sustainment.
- The work environment is psychologically safe such that the workforce can raise concerns or ask questions with full support and encouragement of their leadership.

(See References 5.1 and 5.3, 5.6, 5.7, 5.8, 5.9)

## **Countermeasure 6: Issues Management**

The issues management process can have a significant impact on organizational performance. An effective, efficient, and consistent Issues Management System is key to identifying and mitigating problems, errors, and events. The organizational culture needs to be supportive of the process, openly and fully embracing the process.

The system should accommodate problems, non-conforming conditions, errors, issues, or trends and provide management oversight to ensure effective corrective actions are implemented. The system should do this by providing effective and efficient processes for the dispositioning and assignment of corrective actions, implementing preventative actions, and ensuring verification of effectiveness of the actions taken to fully resolve and prevent future occurrences of the same or similar conditions. The system should require a graded approach to resolution, where higher significance issues receive a thorough analysis of the underlying causal factors, timely corrective actions, effectiveness review, extent of conditions, and documentation of the analysis process and results. Lower significance issues may only require only a causal analysis and implementation and verification of completed corrective actions.

A successful Issues Management System allows for the prioritization of issues based on safety significance and applies for dispositioning in a traceable and transparent manner. With a singular source of the data, issues can be trended, analyzed, communicated, and actions taken before operational upsets occur or actions can be taken to prevent recurrence of similar situations. The system does not need to be complex, but it should be well designed, easy to use, and endorsed by management.

Issues Management Systems require participation at every level of the organization to assure safe and effective project mission performance. The issue management process includes the hands-on workers and supervisors as well as oversight, QA, CAS, ISM, and potentially regulatory, technical, and management, operational, or customer personnel.

Human errors and unexpected events will happen. When they occur, organizations need to ensure they have the capacity to recover quickly and resiliently. Human error is about tolerance and recoverability. Issues management processes should explicitly recognize that human variability is normal (expected) and focus more broadly on system weaknesses, including the rich context behind what causes the undesired outcome.

The variability and potential complexity of each error or nonconformance creates a need for a wide range of expertise, decisions, and steps in the issue management process, including workforce and

leadership level participation. Leaders need to promote the use of the issues management process as a fundamental component of their business. They should encourage a low threshold for issue reporting and positively recognize personnel for reporting issues. Metrics related to issues management should be developed and routinely reviewed and evaluated by the senior management team to monitor the health of the issues management program. To drive an appropriate level of leadership engagement and ownership, management review teams should be employed to routinely monitor issues and corrective actions with a higher degree and level of oversight on a graded approach based on issue/event significance.

### ***Challenges to Implementation***

The following are typical challenges that exist in the implementation of the process. The extent, volume and diversity in the types and extent of issues or noncompliance's and varying interpretations of requirements contribute to opportunities for errors or incomplete or inaccurate results. Inconsistencies in compliance, timeliness, completeness, adequacy, and effectiveness of the issues management process implementation tend to degrade its value and importance to the organization. Variations in interpretations of DOE Orders or National Codes and Standards drive conflicting implementation and inconsistencies that take away from the fundamental premise of learning and improving. These variations can manifest themselves in weaknesses when flowing down or interpreting requirements.

Even when robust systems are used and endorsed by management, if the incoming data or issue description is weak, ambiguous, or missing information, the clarity of the solution or problem may be different from what needs to be addressed and can lead to fixing something that was not broken. Untimely issue identification or delays in realizing an issue that needs to be addressed, can lead to missed opportunities to prevent another event or reduce the severity of the current one.

The system should be flexible enough to allow variations when required but should provide clarity and consistency regarding interpretations of severity categorization and assignment of the level of causal analysis required or effectiveness review performed. This flexibility and consistency should also apply to timeliness, comprehensiveness, and effectiveness of issue resolution.

The Issues Management System can be impacted by personnel who may have limited cause analysis skills or experience. This manifests itself in less than adequate cause analysis, ineffective corrective actions, or effectiveness reviews that miss the key prevention opportunities. Care needs to be taken to prevent issues identified in a system from being assigned too low in the organization. This problem is evident when the determined resolution does not receive the resources or authority necessary to implement corrective actions. The assignment of responsibility needs to have a level of management oversight necessary to ensure effective corrective actions are identified and completed. Without management oversight, there may be another potential operational upset because the best corrective action may not have been implemented. Once the issues have been assigned to the appropriate personnel, lack of ownership and involvement of a busy manager can cause the system to be less than effective or timely.

Management of issues and events can be slow, systems may be complicated to use, or there could be a weakness in data management oversight and control. These are weaknesses that need to be avoided and the goal should be for issue management to take place in as near real time as possible.

Overall, the time and resources required to perform issues management should be viewed as time well spent to prevent future operational upsets, as opposed to being seen as a burden or just another activity impairing performance, instead of improving it.



## ***Focused Improvement Opportunities***

A robust, well implemented, and management endorsed Issues Management System is uniquely positioned to aid in the continuous improvement process and provide operational, as well as performance, improvement opportunities. The goal of a well implemented and successful system is to identify and address issues in a transparent manner and prevent recurrence of similar issues. Issues management data allows for trending of issues to aid management in identifying precursor activities and indicators for use in mitigating operational or performance upsets. Acting on these lagging indicators has the potential for preventing future operational upsets.

Organizations can develop a robust Issues Management System by considering adoption of the following tools or techniques as applicable. Starting at the top, consider chartering senior management leadership as a review and oversight body for the most significant type issues that impact customer relations, have biggest budget implications, have major schedule impact, have resulted in personnel injury, or have other key operational impact. This body can demonstrate by action the leadership ownership and engagement to drive improvements in operational performance.

Consider developing a management team that fosters an environment that embraces organizational learning, open communication, trust, and reporting of issues without retribution. Another opportunity for management (other than the issue owner), is to ensure that compensatory measures are put in place for issues where implementation of corrective actions is significantly delayed due to cost, schedule, staffing or other reasons. The corollary to this is that the system should schedule effectiveness reviews of completed corrective actions at a given point, later in time, to verify the adequacy, continued implementation, and overall effectiveness of the corrective actions. Another opportunity for all levels of management is providing exposure to HPI tools and developing the understanding and application for promoting improvements in the organization through use of tool(s) as applicable. One final opportunity is to reward (by recognition or other incentive) employees identifying “Good Catches” where an event was mitigated or avoided.

Moving into organizational behavior, consider the following workforce improvement opportunities. Like the opportunity for senior management, consider establishing issues screening teams composed of managers and high potential employees. This team should have the role of screening all issues and determining issue significance, responsible issue owner, extent and quality of proposed corrective actions, and appropriateness of issue closure documentation. The team would take on the review and oversight responsibility for less significant type issues that impact organizational performance and operation.

From an Issues Management System perspective, consider the following types of improvement opportunities. One of the first opportunities is to ensure that there is a single, comprehensive, corporate, electronic Issues Management System to enhance sharing, effectiveness of analysis, and trending. Do not allow organizational specific systems, shadow systems, or preliminary systems – these reduce the effectiveness and avoid entry into the overall system. Also as discussed previously, ensure there is a zero-barrier threshold for entry into the corporate system as well as embracing issue identification and “Good Catches.”

Another opportunity is for the development and use of templates or standardized causal analysis reporting. The goal here is to reduce focus on the process and format while improving the focus on consistency, learning from the issues, making improvements, and ultimately prevention of operational upsets. Working along with standardized causal analysis, is the development of site-specific trend



codes that include well-defined site-specific event codes, which consist of “function and process” codes that are combined with “nature of issue” codes. These would add value and relativity for users. Another benefit of using the standardized cause analysis approach is that the investigation, causal analysis, corrective actions, and effectiveness review criteria for each issue are all captured in a single report. One final opportunity is for the Issues Management System to allow issue identifiers to participate in any screening of the issue, to provide feedback during the review and ensure the right issue is being communicated for resolution. In addition, the system should provide feedback to the originator when the issue has been closed.

From an integrated process perspective, consider the following types of improvement opportunities. Issues management and lessons learned procedures should be streamlined to ensure the proper level of rigor is applied based on the significance of the issue. The procedures need to foster a graded approach to issues management and establish categories of significance that require the use of varying levels of analysis. This means that not all issues are treated the same. The most significant would require a root cause type analysis, while less significant issues would only require an apparent cause, while other minor issues and opportunities for improvement type issues may not require any causal analysis. Like the opportunity for management, the same opportunity is available to staff and engineering personnel. This is the opportunity to provide exposure to HPI tools and develop understanding and application of tool(s), as applicable. At this level, personnel can directly apply the tools to correct errors and prevent recurrence. Another opportunity in this area is the application of a consistent approach to event management/investigations. Depending on the event, the approach may include the use of a trained and qualified team. The most benefit would be gained by consistent key members leading the team with the assistance of various subject matter experts as needed for the specific investigation area. The final opportunity is for consideration of an Integrated Assessment Schedule that balances risks, compliance, and interactive engagement from the DOE/NNSA site office. This ensures the focus of resources can be balanced on regulatory needs as well as operational improvements.

(See References 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.8, 5.9.)

## **Countermeasure 7: Risk Management/Assessment**

Risk is inherent in the dynamic and technically innovative work performed at NNSA sites. Managing that risk to ensure the safety and health of the workforce, the public and the environment, while not stifling performance and advancement continues to challenge DOE/NNSA. The level of risk tolerance of a given site may vary, depending largely on the yardstick of leadership.

### ***Challenges to Implementation***

All too often, the process of objective decision making when addressing the needed balance of risk to a more effective and efficient performance process is not clearly defined. As was quoted by a senior DOE representative “Too many instances, a specific task, job, operation, or project is brought to its knees due to the stakeholders not being able to achieve consensus on how to balance risk and get the mission accomplished. Stovepipes are a major contributor on both the federal and contractor sides.”

It is important to note that while all realized risks are issues, not all issues are realized risks. This is because issues include events impacting the project that may be performance based, and performance-based issues are not risks by performance management reporting requirements. For Defense Programs, the specific performance management requirements are defined, based on the

complexity of the projects, in the Execution Instruction, NA-10 *Program Management tools and Processes*.

Determining the likelihood of an event is often subjectively determined based on limited data, which can lead an organization to incorrectly assess risks. Sites need to be cautious that their risk management practices align with the hazards of their sites and the organizational culture espoused. Misalignment may yield inaccurate risk assessments, which may impair personnel from adequately identifying and mitigating risk to a truly acceptable level. What are you doing to align your risks with your mission, vision, and values?

### ***Focused Improvement Opportunities***

- A robust and effective, risk-informed approach to develop, implement, and perform comprehensive assessments of facilities, systems, and organizational elements, including use of subcontractors and other DOE/NNSA site personnel, on a recurring basis. This involves identification, assessment, and control of risks to mission performance.
- The contractor's risk management program should integrate the DOE/NNSA risk program. As risk to the mission increases, the contractor should establish increasing assurance system actions, including the frequency and rigor of assessments.
- A risk consequence matrix should be developed where risk is rated depending upon the likelihood (probability) of occurrence and consequence of realizing the event (See DOE G 413.3-7, *Risk Management Guide* for more).
- The risk consequence matrix provides examples of higher consequence areas that should be appropriately considered in assessment scheduling and oversight activities.

The risk management program is an on-going process used for the identification, assessment, and management of issues, threats, and opportunities. By highlighting enterprise level risks, senior management can strategically position resources and funding to best eliminate or manage potential or impending risk events.

The Enterprise Risk Management process helps define the criteria for how enterprise risk is formally assessed and tracked throughout the organization/project. Once entered into a formal risk register, the risk is closed only upon the event occurrence or full mitigation of the risk(s).

Seeking common ground on risk can bring opportunities to address and builds trust and communication into the project or organization. Preserved risk or conflicting opinion can be brought to a higher level in the organization for effective decision-making alternative.

(See References 5.1, 5.2, 5.3, 5.4, 5.8, 5.17, 5.28, 5.29)

## **Countermeasure 8: Effective Measuring, Monitoring and Oversight**

Monitoring trends and developing actions to drive timely improvements (and more challenging - to sustain realized improvements) is critical to preventing operational events or upsets. How we measure performance will be influenced by an individual site's mission, risk level, and severity of impacts from potential operational events or upsets. Measures are either leading or lagging indicators of performance. Leading indicators indicate likely future performance and are necessary to give an organization opportunity to mitigate trends before suffering an impact on safety, security, or mission deliverables. Lagging indicators, on the other hand, only tell an organization how they performed historically based on past measurement, but can help prevent future recurrence of events and issues.

Management field engagement (active monitoring) is key to continual learning and driving sustained performance to prevent operational events. Active monitoring is a technique used by managers/supervisors/influencers in the workplace who are trying to proactively check the effectiveness of the controls or barriers by monitoring workers in the field and discussing with them the status of those controls as work is being performed. It involves inquiry by the manager/supervisor to confirm worker knowledge and use of the control(s) in real-time. Frequently, there is an assumption that by listing the controls in a work planning document, those closest to the work are completely knowledgeable about what that really means in the conduct of the work. Active monitoring is done to clarify and verify or act if ineffective controls are discovered).

Monitoring and measuring organizational safety culture and corporate climate using validated instruments is a valuable approach to glean insights to opportunities for improvement that will impact performance and reduce event likelihood. Continuous monitoring of the safety culture, as well as the organizational climate, is a valuable approach that provides insights into areas for improvement. The NEI 09-07 Revision 1 model is valuable because it promotes monitoring and measuring at all levels of the organization, utilizing existing organizational information to prompt leadership discussion around behaviors and behavior modification.

Management should understand, support, and value the use of performance trending through metrics and analysis, as evidenced by actions they are taking to improve performance. Management review teams should be employed to routinely monitor issues and corrective actions with a higher degree and level of oversight for more significant issues. Additionally, key performance data should be periodically reviewed and evaluated by corporate/parent company management as part of an overarching assurance model.

### ***Challenges to Implementation***

Often organizations measure what is easy, rather than what is of value to them, which should be outcomes - whether they are meeting their goals and objectives. Measuring for the sake of measuring with no clear targets for performance, trending, or actions to improve performance is futile. This leads to analysis paralysis.

Not having a means to examine all the data collectively or unfiltered has been reported by several sites. Often data is being tracked in multiple systems, leading to incomplete or unclear pictures of organizational health and performance. The lack of integration of data systems and multiple reporting channels without true alignment between multiple reporting mechanisms (e.g., executive dashboards, balanced scorecards, key performance indicators, etc.) continues to be problematic.

## ***Focus Improvement Opportunities***

Opportunities for improvement for effective measuring, monitoring and oversight, center around the development of viable leading metrics, recognition of adverse trends, and management review of the metrics, and the development and follow up of actions to mitigate adverse trends.

Developing and monitoring meaningful metrics and targets aligned to mitigate operational upsets and assess the effectiveness of performance is another way to enhance performance. This includes benchmarking of key functional areas with other DOE contractors, industry, and research institutions. Integrating metrics activities with objectives and key results (OKRs) and key performance indicators (KPIs) through an institutional dashboard is another way to leverage performance opportunities. Weighting measures based on severity and potential impact, or consequence is important to allow appropriate determination of responses and action development.

Dashboards that showcase leading and lagging indicators are proving to allow effective and efficient monitoring and decision making. Analysis, trending, and measuring of CONOPS performance can be tied directly to the Safety Performance Objectives, Measures, and Commitments (SPOMC) program. This suite of metrics ensures an agreed-upon approach to measuring and monitoring performance of key elements related to, and reflective of CONOPS performance.

A strong management review process and issues management program is imperative to monitor and drive sustainable improvements on a short-term basis, e.g., monthly reviews. Performing a deep dive of performance data over a longer period is beneficial to identify common causes or performance degradation, e.g., deep dive of operational related performance data, or analysis of all issues that may indicate cultural shifts in performance.

(See References 5.1, 5.2, 5.3, 5.17, 5.18, 5.26, 5.28, 5.29)

## **CONCLUSION**

This white paper provides an analysis of current DOE/NNSA performance improvement initiatives, challenges, opportunities for improvement, and current initiatives. It further recommends strategic focus on eight specific, long-term countermeasures for achieving and sustaining DOE/NNSA performance improvement to minimize “Operational Upsets.”

The driver behind this evaluation was NNSA PEMP objective 5.5 (originally 6.5):

*Demonstrate leadership in driving enhanced and sustainable formality and rigor of operations through proactive implementation of effective and efficient measures to minimize operational upsets that have potential to impact mission.*

The focus of this document is to provide prevention or mitigation strategies for operational upsets by building capacity and resiliency into leadership, organizational structure, culture, management processes and systems, and performance to achieve mission delivery.

This white paper reflects the collective experience of DOE Prime and M&O Contractors. It is intended to be robust and applied according to the hazards and complexity of work activities at a given organization, project, or site. This information should be applied in a graded approach based on the facility approved safety basis and risk ranking for a broad range of nuclear and non-nuclear applications.

This White Paper describes suggested non-mandatory approaches for meeting DOE requirements and directives. This document does not contain requirements and is not to be construed as requirements in any audit or appraisal for compliance with DOE requirements and directives. DOE requirements, directives, and other guidance material have been referenced to provide context.

The identified challenges, opportunities for improvement and current Contractor initiatives are provided for each of the eight identified countermeasures. These are not intended to be isolated items to address but are potential countermeasures for long-term ongoing efforts. They are an attempt to build a strategic long-term approach for ongoing continuous improvement. The recommendation for eight strategic countermeasures includes key roles and influence for all parts of DOE/NNSA complex. This review included a cross-section of all of DOE and therefore the results can be applied (as appropriate) to all parts of DOE/NNSA. These include:

- Prime Contractors, M&O project/task performance and oversight, including subcontractors contract performance and oversight.
- The specific role and mission of NNSA as described in this white paper is based on NNSA Report of CONOPS A3 working group recommendations.
- DOE/NNSA and their role in mission, ownership, regulation, contracting, management and leadership, oversight.
- DNFSB and their mission, oversight and advice.

Specific industry references are included to provide a deeper level of detail. The appendices are organized for easy access to the level of detail desired. Specific individual and organization level needs can provide a good starting point for the overall use of this information throughout EFCOG and overall DOE complex.

## **Appendix 1: Current Countermeasure Good Practices and Examples**

The following practices and examples have been, or are being, incorporated at various sites across the DOE complex and are shared here to stimulate ideas for improvement. For more information on a specific example, contact the EFCOG team who can help or put you in touch with the appropriate parties. Not all countermeasures have multiple examples further emphasizing that these areas need to be addressed.

### **Countermeasure 1: Leadership Engagement and Ownership**

#### *Example 1: Mission Support and Test Services (MSTS) LLC, Nevada National Security Sites (NNSS)*

At the start of the contract period of performance, NNSA added a commitment to the site's contract to reduce "Operational Upsets" by 50 percent over the base period from the previous contract. To address the commitment, there was a challenge in truly defining what "Operational Upsets" are with evidence of lack of alignment resulting in a non-unified approach to managing operational upsets or defining/obtaining previous base period picture.

The site works collaboratively with NNSA to gain alignment on what an operational upset is and what is the baseline from the previous Contract. In summary, what the NNSA wanted was to stop interruptions in delivery of mission which has plagued most sites in the site complex. Thus, the focus is around what stops mission delivery and eliminating/reducing idled costs in a significant way.

To address the problem, a preventative approach was required that focused on a quality assurance and mission delivery approach. This transpired to refinement of technical requirements for items and services by three types of life cycle activities: engineering, procurement, and installation. This includes utilizing the cognizant functional subject matter experts (SMEs) from Engineering, Project Management, and Facilities to help determine overall technical requirements and overall quality assurance requirements to assure technical requirements are being met. This includes focused quality assurance requirements based on end use of item or service with a focus on risk and identifying the controls necessary based on the activity being performed. This further includes identifying if the item/service works as intended, if any risk determined to be realized is being appropriately managed and utilizing an issues management process focused on identifying and managing potential operational upsets.

#### *Example 2: Consolidated Nuclear Security, LLC (CNS) – Pantex Plant/Y-12 National Security Complex*

The site has developed a unified understanding of disciplined operations that is comprised of multiple systems, processes, and models. The point of the CSN Mission Success Model is that every situation is different. Operations must have the core capabilities such as people, technology and innovation, processes and systems, and the infrastructure required to ensure mission success. The model makes use of CONOPS manuals and a disciplined operations work model.

CONOPS Manuals – The manuals provide a foundation to ensure that management systems are designed to anticipate and/or mitigate the consequences of human fallibility or potential latent conditions and to provide a vital barrier to prevent injury, environmental impact, or asset damage, and ensure mission success.

Disciplined Operations Work Model – this model focuses on the pillars of training, technical procedures, and supervision. These three important pillars are key to working interdependently to execute safe work and ensuring the right culture is sustained along with internal oversight supporting all three.



Training – This is the knowledge, skills, abilities, and experience of the team that is assigned the work. Having qualified people with a validation process is a positive leading indicator. The more training and experience the team has, the less supervision, oversight, and procedural guidance the team needs. This sums up an efficient approach.

Technical procedures – Specific instructions should be followed, should be correct and provide enough detail for newly trained workers to successfully complete tasks safely. The goal is to have the right technical guidance that is both clear and concise. Knowing the qualification level of the audience is imperative. The more detailed the step-by-step guidance given, along with trained and qualified workers, ensures better outcomes. Procedure use and adherence is an integral part of the organizational culture of excellence.

Supervision – Supervisor presence and oversight are imperative to support safe, secure, and high-quality operations. Supervisors need to ensure workers are trained, qualified, and prepared for the task at hand to accomplish the mission. Supervisory presence in the work areas helps establish good working relationships with employees and a positive work culture. It also helps supervisors monitor workers to reinforce good work practices and coach to correct those practices that don't support mission success. Through oversight, supervisors maintain insight into the pulse of the organization and stay apprised of any problems that need to be addressed proactively.

The site uses culture surveys, benchmarking, metrics, and deep dive analysis to define/measure success. They also use an automated dashboard, a disciplined operations plan, a continuous improvement plan, and have created a Disciplined Operations Council.

A culture survey provides a method to assess gaps in organizational performance and help predict future performance through a survey process. The results are a snapshot in time used to measure meaningful elements of the overarching organizational culture to establish a baseline for management on leadership engagement, supervisory support, employee participation, and safety programs and activities, as well as the safety and organizational climate.

Benchmarking other organizations is an integral part of development and growth for any learning organization. It provides an opportunity to compare what is imagined versus work as done. It also allows the opportunity to share best practices or learn from others.

Other tools used include automated dashboards (e.g., Tableau) to monitor performance. This provides a granular look at performance, making metrics transparent and easily accessible. In addition, the data is focused (floor observations, CONOPS events, procedure cycle time, issues management data).

The site uses 4-Pronged Discipline Operations Integrated Plan. The four prongs are enhancement of metrics and performance monitoring, employing a communications campaign/plan, increased field engagement, and procedure improvements. The site additionally devised a Continuous Improvement Plan that is focused on high-risk/high-consequence areas, training, and technology and procedure improvements. Lastly, they created a Disciplined Operations Council which joins the site and NPO into a council focused on operational challenges like tactical and strategic mission and goals, leadership ownership, to escalating CONOPS issues and providing cross-site/organizational collaboration.

### *Example 3: Lawrence Livermore National Laboratory (LLNL)*

The site is using a two-pronged approach to meet objective 5.5. First, each year they focus on specific areas for improvement via use of the SPOMC Action Plans. Management commits to specific performance measures and tracks them to completion throughout the year. For example, in FY23 they



are tracking things like the hearing conservation medical surveillance program, hazardous waste operations, and vehicle and pedestrian traffic among others. The second part of the approach leverages the CAS not only in self-assessing, performing root and causal analysis, and tracking corrective actions to closure, but also in the areas of measurement and monitoring and risk management.

The site is in the process of integrating both risk management and monitoring and measurement activities with OKRs and KPIs using an institutional dashboard.

*Example 4: Sandia National Laboratory*

The site hired a Chief Culture Officer to spearhead a lab-level approach for organizational culture improvements. The intent is to ensure elements of safety, security, diversity, equity, and inclusion, along with other important organizational culture aspects are collectively addressed through one effort. This includes establishment of a chartered team to work on organizational culture improvements reporting to executive leadership.

*Example 5: Savannah River Tritium Enterprise (SRTE)*

Savannah River Tritium Enterprise (SRTE) Uses the Plan, Do, Check, Act tool to manage reduction of Conduct of Operations type events.

Plan:

Risk-based Assessment Planning: SRTE uses a risk-based assessment planning methodology to ensure self-assessments identify opportunities and threats for improvement and closing gaps in requirements. SRTE has developed a suite of indicators for accessing overall operational performance and look at data typically over a rolling 12-month period to identify risks and elements of performance that need improvements. Risk-based assessment planning uses standard risk determination methods around likelihood and consequence and impact to determine areas of assessment focus. The informed data includes human and organizational performance information to ensure systemic view of areas to focus on/improve.

Targeted Management Field Observations (MFO): The site has a robust MFO program that is critical to improving overall operational performance. This includes observations around CONOPS focus areas (e.g., procedure adherence, housekeeping, logbook keeping, postings/operator aids, etc.). Each quarter the site area operations managers evaluate CONOPS performance data and institute targeted subject management field observations to focus on reversing negative trends. Observations are often done in a team fashion and take into consideration manager experience coupled with involvement of SMEs and other experienced staff to assist and provide coaching as necessary. The approach is not performed as a formal inspection but more of an informal walk-down to create a physiologically safe environment for workers to feel at ease in bringing forth challenges to getting work done safely. Checklists may be developed to ensure the observations are focused. Data collected are categorized as opportunities for improvement and findings and include subject areas beyond the original focused subject MFO (e.g., housekeeping, communications, procedure adherence) that could lead to other future targeted management observations.

The site established a PISP which is a living document that serves as a tool to capture actions to improve and sustain performance over time. The PISP is owned by senior leadership and is reviewed and revised at least every six months. The actions are influenced by a semi-annual performance

analysis. The Management Review Board is a forum to review the performance analysis and manage the PISP process. The outcomes of the plan could result in more deliberate measures to improve performance such as the institution of more rigorous oversight such as Senior Supervisory Oversight and Targeted MFOs.

Do:

Perform assessments: From the established risk-based assessment plan/schedule, assessments are performed and tracked to completion including identification and classification of issues identified.

MFOs are performed per targeted areas. MFOs and assessments feed metric data sets for trending including semi-annual roll up of data to inform operational performance. Through assessments and MFOs findings and opportunities for improvement are identified and uploaded into the issues management system for review and compilation of data sets to support semi-annual performance analysis.

Check:

Monthly review of the severity indices and a semi-annual performance analysis: The site has developed a set of CONOPS, Safety, and Security performance indices based on severity of issue/incident in which they apply distinct weighting scores commensurate with the severity. These metrics trend performance and inform the semi-annual performance analysis. Additionally, the site tracks good catches as part of a leading indicator and to promote a healthy reporting culture. The good catches are analyzed at least semi-annually and inform the performance analysis. The Good Catch Program supports an employee recognition program.

The Monthly Review Board (MRB) also meets twice a year to review PISP actions, recent trending data (to make executive decisions related to improved performance) and to determine if existing improvement efforts are working. The MRB process ensures that a deliberate focus of actions from the PISP process are reviewed by leadership to drive leadership ownership, engagement, and accountability.

Act:

Revise PISP Actions: PISP actions are revised as needed through the MRB.

Revise Targeted areas for MFO. Based on current performance trends, targeted areas for MFO may be revised and communicated to responsible parties.

Revise Assessment Strategy: As with the MFO process, the assessment strategy process is also dynamic in that the assessment plan may be revised to address changes in performance.

The site evaluated their current operations performance assurance data set against the NNSA CONOPS Working Group results to determine if there were any gaps between the NNSA recommendations and the site process. This was done via a crosswalk which resulted in areas of improvement.

*Example 5: Battelle*

Battelle operates in seven national labs and has deployed a leadership organizational model with a key leadership position within program execution directorates to better integrate mission support and mission execution requirements to improve overall mission delivery. This position operates in a chief

operations officer capacity and supports the Associate Laboratory Directors (ALDs) by ensuring that operational requirements, processes, and support resources are in place to meet the managements responsibility for conducting work in compliance with requirements. The Directorate Chief Operating Officer (DCOO) has the authority and accountability to make key decisions and provides overall operational supervision for execution of work, management of safety, security, workforce diversity, professional development, and operational management for all divisions and programs within their respective programmatic directorate. Just as important, the DCOOs, collectively with the Senior Leadership Teams, ensure a consistent approach to overall assurance across the organization, thus eliminating shadow systems, stove pipping, and inconsistent models that tend to further complicate integration across organizations.

### **Countermeasure 2: Implementation of an Integrated Management Systems Model**

Most NNSA Contractors have initiated plans of varying degrees to better focus integrations models between performance and oversight and support functions to achieve mission success while eliminating or minimizing “Operational Upsets.”

#### *Example 1: Sandia National Laboratory*

Improvements are being made in Sandia’s management system approach transitioning from a compliance mindset to risk-based proactive approach. This is being done through multiple assurance tools including providing ES&H data to drive and support division-specific Safety Improvement Plans, development and implementation of ES&H Governance Board and the executive leadership team management assurance review board, a more user friendly Lessons Learned Program, a stronger risk-based approach to assessment planning, stronger coordination and collaboration of a Labs-Wide Integrated Assessment Schedule, and a Balanced Scorecard approach to monitoring operational performance to support executive leadership reporting and engagement.

#### *Example 2: LLNL*

Lawrence Livermore National Security, LLC developed a Work Planning and Control (WP&C) program and process designed to ensure comprehensive and sustainable implementation of ISM. The “...LLNS WP&C institutional program is a best practice and could serve as a model for other U.S. Department of Energy (DOE) laboratories. (DOE Office of Enterprise Assessments - August 2020)

Refer to DES-2012, *The LLNL Work Planning and Control Program*.

### **Countermeasure 3: Supervisor (Front Line Manager) Involvement**

DOE expects front line leaders and workers to support a strong safety culture where "safe performance of work and involvement of workers in all aspects of work performance are core values." The purpose of this course is to train DOE federal and contractor front line leaders on how to establish and maintain a trusting and collaborative safety culture where all employees feel free to raise concerns.

#### *Example 1: Savannah River Site*

The site has taken tangible steps over the recent past to improve formality and rigor for organizational culture in CONOPS by developing a CONOPS Program Plan.

The CONOPS Program Plan is updated at least annually. For sites or organizations that have multiple facilities/areas/contractors this plan does not get down into facility or area specifics; it provides an overarching plan for the “big picture”. It helps coordinate collaboration efforts with various groups by:

- Focusing more CONOPS and HPI training on FLMs and Shift Managers.
- Increasing CONOPS and HPI elements in our routine continuing training plans.
- Using CONOPS coaches in our nuclear facilities (usually experienced retired personnel under contracts).
- Developing a web-based library of short (1-5 minute) videos that cover a single element of CONOPS or HPI.
- Developing a web-based library of HPI dynamic learning (hands on) activities that are fun and reinforce HPI and conservative, disciplined operations.
- Using new employees to develop the videos and learning activities.
- Establishing a dedicated HPI lab in our main training building onsite. Using electronic HuPerT HPI trainers.
- Leveraging EFCOG contacts for sharing/collaborating.
- Using CONOPS Minutes (concise disciplined operations topics that can be used during shift briefings and toolbox meetings)

#### *Example 2: Los Alamos National Laboratory*

The site is currently sending their FLMs through Battelle's Laboratory Operations Supervisor Academy (LOSA) training and tracking completion of training as an institutional metric to improve overall organizational safety culture. Battelle's LOSA training is partly built around role-playing scenarios recreating actual problems that peers participate in and work through. The scenarios are based on real-life work problems, such as difficult employees, and other work-place issues.

The site has set up forums for LOSA graduates to share best practices and foster integration amongst the FLMs. These forums promote voice, unity, and shared strength/resources to grow as an individual and as a group by building a culture based on ownership and trust. The forums provide an opportunity to get supervisors together to confront similar real-world issues they are faced with daily. The forums also give supervisors the opportunity to tell management where their knowledge gaps exist and solutions for filling the gaps.

#### *Example 3: Sandia National Laboratory*

The site is currently piloting a one-day FLM training designed to increase resilience to operational events by preparing and empowering FLMs to positively affect organizational culture. The SNL safety culture training is based on the Safety Academy for Excellence (SAFE) training that is/was being conducted jointly with multiple laboratories (at least six others) which is an off-shoot of the site is employing Battelle's LOSA Program, a DOE best practice. This training is a two-day immersion, leadership development workshop that features presentations, learning activities, and application through scenario process. The course objective is to strengthen FLMs' awareness of how critical their role is in fostering a healthy and shared culture and then give them a "safe" and structured environment to practice behaviors that help create productive and physical and psychologically safe working environments. The site has piloted their safety training in the Facilities and Infrastructure organization.

Current efforts to expand training to other work groups are planned for FY23, including inclusion into FLM training plans.

The site's Organization's Labs-wide Safety Culture Program focuses on the following elements:

- Equipping managers/leaders to lead a positive shift in their respective organizations (and organizational cultures) by fostering a work environment that promotes trust, a questioning attitude, and receptiveness to raising concerns.
- Preparing managers/leaders for promoting, adopting, and maintaining a strong Safety Culture within their respective organizations.
- Equipping managers/leaders for conducting effective workplace observations, and engaging in effective interactions with their staff to support a Safety Culture.
- Encouraging managers/leaders to allow others to be vulnerable and ask for help when needed, and to actively and confidently create an enduring safety legacy.
- Training managers/leaders to create a strong sense of 'belonging' and mutual purpose among their staff to improve engagement, motivation, and retention of personnel.
- Enabling Sandia to manifest the attributes of a learning organization as it achieves Mission success.

The site's Safety Culture Program consists of five key components, with the first being supported and reinforced by the other four. All are intentionally designed to develop and accelerate proficiency – ultimately to the point of mastery – in five interdependent focus areas:

- 1) *Safety Culture Academy* is a one-day leadership development workshop designed to enhance the ability of managers/leaders to influence/create a stronger safety culture across Sandia and increase overall resilience. This workshop strengthens participants' awareness of their critical role in fostering a healthy and shared safety culture and provides them with a "safe" and structured environment to practice the principles, language, and behaviors that help them create productive and safe working environments. The workshop focuses on creating physically and psychologically safe environments by increasing resiliency in managing day to day operational challenges and conditions. Participants also learn how to improve engagement with direct reports, co-workers, and peers to enhance organizational learning and performance through interactive scenarios. The Safety Culture Academy is based upon the former Safety Academy for Excellence (SAFE) course, Battelle's LOSA, and the DOE's Safety Culture courses for Sr. Managers and Front-Line Supervisors.
- 2) *Leading at the Speed of Trust* is a two-day workshop that engages and prepares managers/leaders to identify and close the trust gaps that exist in their respective organizations (e.g., office politics, interpersonal conflict, "elephants" or "undiscussables," churn/turnover), and turn trust into a strategic advantage by lowering costs, speeding up results, and increasing success and influence. This workshop includes tools to help leaders improve trust – the trust people have in them, and the trust within their organizations – so they can realize the impacts of increased trust: enhanced innovation, stronger partnering and collaboration, better execution, heightened loyalty, and greater

commitment to achieving results. Leading at the Speed of Trust is supported with resources from Franklin Covey and is augmented by the one-day Speed of Trust Foundations workshop for staff.

- 3) *Crucial Conversations* is a two-day workshop that teaches skills for talking about tough subjects/issues – and for fostering open dialogue around high-stakes, emotional, or risky topics, at all levels of the organization. This workshop teaches participants how to step up to, and have, effective conversations about impactful organizational problems (e.g., poor quality, chronic schedule delays, conflicting priorities, office politics, strained relationships, and dismal results) so they can be resolved. Participants learn how to: speak persuasively versus abrasively; foster teamwork and better decision making; build acceptance versus resistance; and resolve individual and group disagreements. *Crucial Conversations* is supported with award-winning resources from VitalSmarts/Crucial Learning.
- 4) *Crucial Accountability* is a one-day workshop that builds on the skills learned in *Crucial Conversations* – teaching skills for effectively resolving personal accountability challenges (e.g., missed deadlines, broken promises/commitments, violated expectations, and inappropriate behavior). This workshop teaches participants how to diagnose why someone keeps falling short of set expectations and then derive a plan that both motivates and enables the other person to successfully change their behaviors). *Crucial Accountability* is supported with award-winning resources from VitalSmarts/Crucial Learning.

HPI training and tools provide a holistic approach to reducing the frequency and severity of human error while addressing organizational factors, system and process weaknesses, job-site conditions, and individual behaviors that negatively impact performance and results at both the individual and the organizational level. This training improves understanding about human performance and suggests how to manage it within an overall organizational system to build capacity to reduce the frequency and severity of events triggered by human error. Primary focus areas include anticipating, preventing, catching, recovering, and learning from active errors at the job site; and identifying and eliminating latent organizational weaknesses that provoke human error and degrade defenses against error and the consequences of error. The impacts of organizational culture, system design, and leadership practices on worker behaviors are discussed. Judging human behavior within a “Just Culture” is a central theme.

#### **Countermeasure 4: Workforce Onboarding, Proficiency and Retention**

##### *Example 1: MSTs, NNS*

The site has addressed the proficiency of cause analysis. Knowledge, skills, and abilities are a key component of the cause analysis process. This is an art rather than a science. People skills and interview techniques can be the difference between getting to the true cause or just identifying contributing causes or solving the wrong problem. Mentoring cause analysts can provide dividends resulting in effective cause analysis, effective development of corrective actions, identification of key prevention opportunities, and identification of what a future effectiveness review should evaluate.

##### *Example 2: Consolidated Nuclear Security, LLC (CNS) – Pantex Plant/Y-12 National Security Complex*

CNS has developed a unified understanding of Disciplined Operations that is comprised of multiple systems, processes, and models:

- Developed understanding of Disciplined Operations:



- CNS Mission Success Model.
- ConOps Manuals.
- Disciplined Operations Work Model.
- Communications campaign/plan.
- Increased field engagement.
- Procedure improvements.
- The disciplined operations work model focuses on the Pillars of Training, Technical Procedures and Supervision
  - Training – this is the knowledge and experience of the team that is assigned the work. Having qualified people with a validation process is a positive leading indicator. The more training and experience the team has, the less supervision and procedural guidance the team needs. This sums up an efficient approach.
  - Technical procedures- Specific instructions should be followed, should be correct and provide enough detail for workers to successfully complete tasks safely. The goal is having the right technical guidance that is both clear and concise. Knowing the qualification level of the audience is imperative. The more detailed the step-by-step guidance is, the less training you need.
  - Supervision - Supervisor presence and oversight are imperative to support safe operations. Supervisors need to have a questioning attitude and ensure workers are prepared for the task at hand and ready to accomplish it safely. The more supervision and safety oversight involved with the work, the less training and technical guidance needed for the workforce.

Consolidated Nuclear Services (CNS) strives to include supervisor involvement on the ground floor as a strong reliance for operational success. This includes a deliberate approach to observations and coaching of the workforce by their supervisors to have a strong pulse on how work is being performed. Y-12 has developed a rigorous Tiered Approach to Floor time presence.

*Example 3: LLNL*

LLNL is using a two-pronged approach to meet 5.5. First, each year they focus on specific areas for improvement via the use of Safety Performance Objectives, Measures, and Commitments (SPOMC) Action Plans. Management commits to specific performance measures and tracks them to completion throughout the year.

LLNL has dedicated resources working with the functional area managers and the program leads to coach and mentor them through the process of establishing meaningful metrics.

LLNL is working with the functional area managers and the program leads to coach and mentor them through the process of determining risks. In FY23 they generated their risk register using information in an enterprise risk management (ERM) tool. Next steps include identifying the ten top risks from each area and the top 15 institutional risks.

In the area of measuring and monitoring, LNL has dedicated resources working with the functional area managers and the program leads to coach and mentor them through the process of establishing meaningful metrics.

*Example 4: LANL*



LANL is currently sending their FLMs through Battelle’s Laboratory Operations Supervisor Academy (LOSA) training and tracking completion of training as an institutional metric to improve overall organizational safety culture. Battelle’s LOSA training is partly built around role-playing scenarios recreating actual problems that peers participate in and work through. The scenarios are based on real-life work problems, such as difficult employees, and other workplace issues.

#### *Example 5: SNL*

The SNL Safety Culture Program consists of 5 key components, with the first being supported and reinforced by the other four. All are intentionally designed to develop and accelerate proficiency – ultimately to the point of mastery – in 5 interdependent focus areas: (See Countermeasure 3 above for details)

1. Safety Culture Academy, a 1-day leadership development workshop designed to enhance the ability of managers/leaders to influence/create a stronger safety culture across Sandia and increase overall resilience.
2. Leading at the Speed of Trust, a 2-day workshop that engages and prepares managers/leaders to identify and close the trust gaps that exist in their respective organizations (e.g., office politics, interpersonal conflict, “elephants” or “undiscussables,” churn/turnover), and turn trust into a strategic advantage by lowering costs, speeding up results, and increasing success and influence.
3. Crucial Conversations, a 2-day workshop that teaches skills for talking about tough subjects/issues – and for fostering open dialogue around high-stakes, emotional, or risky topics, at all levels of the organization.
  - Increasing CONOPS and HPI elements in our routine continuing training plans.
  - Using CONOPS coaches in our nuclear facilities (usually experienced retired personnel under contracts).
  - Developing a web-based library of short (1-5 minute) videos that cover a single element of CONOPs or HPI.
  - Developing a web-based library of HPI dynamic learning (hands on) activities that are fun and reinforce HPI and conservative, disciplined operations.
  - Using new, young workers to develop the videos and learning activities.

### **Countermeasure 5: A Learning Organization and Psychological Safety**

*Examples – these come from multiple sites.*

- Managers support the use of worker-led learning teams or other Human Performance Improvement (HPI) tools to identify and recommend workplace improvements.
- After action reviews, debriefs, and fact findings are performed soon after events to provide information needed for causal analysis.
- Responsible managers and subject matter experts participate in industry working groups and benchmarking reviews to share experiences and bring improvement opportunities to their programs.
- The use of operating experience/lessons learned information is monitored and trended for improvement.

- Building in HPI lines of questioning within pre-jobs/post-job briefs (error precursors, what can go wrong/what must go right, etc.)
- Utilizing STAR principles (stop, think, act, review)
- HPI focus during causal analysis.
- Culture surveys to determine perspective of workforce.
- Culture assessments: DOE EA periodically conducts safety culture independent assessments across the DOE/NNSA complex to monitor and evaluate DOE contractor safety culture self-assessments and employee survey methodologies, perform in-depth safety culture assessments of select DOE and contractor organizations, and limited scope safety culture assessments as part of technical oversight assessments. These assessments evaluate perceptions about the effectiveness of organizational factors to support safe mission accomplishment. DOE EA has developed a criteria and review approach document to enable assessors to examine consistencies in attitudes and behaviors indicative of safety culture. Such attitudes and behaviors are identified in Attachment 10 to DOE G 450.4-1C, Integrated Safety Management System Guide, as “focus areas and associated attributes”.
- The use of emerging technology such as artificial intelligence (AI) and should be considered for mining the OPEXShare for lessons learned and should be utilized as practical and possible in the changing world we live in. Information gathered with sources such as this can be incorporated into the work documents and the work authorization processes to identify potential upset conditions before they occur. Additionally, this information could be used to support continual training programs.

## **Countermeasure 6: Issues Management**

*The issues management process has been implemented across the complex. While the processes are not the same, by implementing consistent attributes, significant improvements to organizational performance can be obtained.*

The issues management system is an employee driven effective, efficient, and consistent source of information that identifies operational improvement opportunities. Employees closest to the work or problem want to get it done right and prevent errors or injuries and thereby reduce or eliminate potential operational upsets, rework, or schedule slips. Unless the process is fully embraced by management, lower-level precursor events will continue to occur or be brushed off without the appropriate level of rigor used to determine the cause and prevent recurrence. A healthy and robust issues management system will identify problems, errors, and events as well as ensuring mitigation or corrective actions are implemented to preclude recurrence. Organizational cultures that embrace and encourage issue reporting will be able to identify problems early before they become chronic or severe.

The basic systems will accommodate reporting of problems, non-conforming conditions, errors, issues, or trends. Effective systems provide a responsible manager for each issue with the responsibility to ensure effective corrective actions are developed and implemented. Once the corrective actions have been implemented, verification of the effectiveness of the corrective actions taken should be performed to ensure the issue has been fully resolved and there have not been additional occurrences of the same or similar conditions.

Most systems have established a graded approach to issue significance and resolution. In these systems, higher significance issues receive a more thorough analysis of underlying causal factors.

Timeliness of corrective actions should be a key component of the process. Issues that are promptly identified and not corrected for years lower the effectiveness of the program as well as the willingness of the workforce to report issues that appear to go unacted on. While some issues will take longer to correct, by involving the issue identifier and keeping them informed, the effectiveness, understanding, and trust in the process increases.

Many organizations have issues management systems that promote a zero-threshold tolerance for issue entry. This system design allows for any issue to be identified and the system for prioritization of the issue based on various attributes and ensures dispositions are traceable and transparent. With the zero-threshold tolerance, the issues management database becomes the key source for performance data, trends, and actions taken that should prevent future operational upsets or recurrence of similar situations. These systems do not need to be complex, but should be well designed, easy to use, and endorsed by management.

Issues management systems that are open to every level of the organization will assure work force participation, acceptance, and drive improvements in safe and effective project mission performance. The input from the hands-on workers allows managers and supervisors to see problems or issues that they may not be able to see. These open systems realize that human errors can occur and are about tolerance and recovery. The focus is on identification of system weaknesses, the cause, and prevention of future occurrences.

Successful issues management programs can accommodate the variability and complexity of a wide range of errors or nonconformances and includes leadership participation. They are also based on data management systems that can provide metrics that are routinely reviewed and evaluated by the senior management team to monitor the health of the organization's performance. Issue review and screening teams drive an appropriate level of leadership engagement and ownership to routinely monitor issues and corrective actions.

Consistent compliance, timeliness, and completeness of issue identification and resolution tend to increase the value and importance of the process to the organization. The EFCOG Contractor Assurance Community of Practice is a great forum to provide complex wide improvements and reduce variations in interpretations of DOE Orders or National Codes and Standards. The Contractor Assurance Community of Practice is where issues management personnel can present and discuss potential questions related to requirement implementation, learning, and process improvements. The Contractor Assurance group can eliminate variations or weaknesses in flowing down or interpreting requirements.

Knowledge, skills, and abilities are a key component of the cause analysis process. This is an art rather than a science. People skills and interview techniques can be the difference between getting to the true cause or just identifying contributing causes or solving the wrong problem. Mentoring cause analysts will provide dividends resulting in effective cause analysis, effective development of corrective actions, identification of key prevention opportunities, and identification of what a future effectiveness review should evaluate.

Personnel assigned resolution must control the resources and have the responsibility necessary to affect the necessary corrective actions. Even issues assigned to the right personnel may lack ownership or involvement due to a manager's other priorities. That is why oversight of the process can prevent repeat issues and ensure timely resolution.

The goal of a well implemented Issues Management Systems is to identify and address issues in a transparent manner and to prevent recurrence of similar issues. This includes the use and understanding of the data in the system, identification of precursor activities, trends, and indicators of operational or performance improvement needs.

### **Countermeasure 7: Risk Management/Assessment**

#### *Example 1: MSTs, NNSA*

The site established a Risk and Issues Board with responsibility for review and screening of all issues regardless of risk or issue. To ensure transparency, while non-members of the Risk and Issues Board, DOE/NNSA counterparts are included as standing invitees to the review process.

#### *Example 2: CNS – Pantex Plant/Y-12 National Security Complex*

The site is working with the functional area managers and the program leads to coach and mentor them through the process of determining risks. In FY23 they generated their risk register using information in an enterprise risk management (ERM) tool. Next steps include identifying the ten top risks from each area and the top 15 institutional risks.

#### *Example 3: MSTs, NNSA*

An institutional approach to managing risk was developed in 2018. It was based on the realization of imminent failure of the safety program and CAS. The primary focus of the improvement was to focus on preventive risk management, avoiding surprises, and preventing significant disruption to mission delivery. To accomplish this, leadership was consulted to define or refine known risks (the drivers) and begin developing handling plans for mitigation. In the next phase, the risks and handling plans were prioritized and ranked.

During this phase, issues management and risk management were integrated into the review and evaluation process. This served to close the loop and reduce organizational stovepipes. As part of this phase, a Risk and Issues Board was established with responsibility for review and screening of all issues regardless of risk or significance. To ensure transparency, while non-members of the Risk and Issues Board, DOE/NNSA counterparts are included as standing invitees to the review process. In the next phase, the baseline was established. This involved reading, reviewing, and understanding every issue identified in the previous two years. These were classified into impacted safety management program areas. The operational upsets were also identified and a rolling average metric of events against total labor hours worked was established. The final implementation phase consists of measuring and reporting feedback. Specifically, in addition to attendance at the Risk and Issues Board, DOE/NNSA is provided with daily, weekly, and monthly reports on results. Results are also provided to DOE/NNSA on the PEMP where successes and regressions are identified in these trimester reports. The operational upset metric was standardized, and a performance goal established based on the number of occurrences per 200,000 hours worked.

*Example 5: SRTE*

The site uses risk-based assessment planning, targeted management field observations (MFO), and a Performance Improvement Sustainability Plan (PISP) for their planning.

The site uses a risk-based assessment planning methodology to ensure self-assessments identify threats and opportunities for improvement and to close gaps in requirements. The site has developed a suite of indicators for accessing overall operational performance and reviewing data (typically over a rolling 12-month period) to identify risks and elements of performance that need improvements. Risk-based assessment planning uses standard risk determination methods based on likelihood, consequence, and impact, to determine areas of assessment focus. The informed data includes human and organizational performance (HOP) information to ensure a systematic view of areas to focus on/improve.

*Example 6: Pacific Northwest National Laboratory (PNNL)*

The site has documented a best-in-class framework for an integrated risk and issues management process, *Integrated Issues and Risk Management: A Theoretical Framework* (see reference 5.21). The purpose of this document is to provide a process that will deliver a robust feedback loop between risk management and issues management to:

- Enhance risk identification and characterization.
- Use risk handling principles to improve corrective action planning.
- Ensure regulatory compliance.

The key element to a successfully integrated risk and issues management system is communication. In many organizations, separate teams are responsible for Risk Management and for Issues Management (otherwise known as Corrective Action Management [CAM]). To ensure these teams gain the benefit of each other's knowledge, it is critical to develop a feedback loop that allows each group's expertise to support the other.

**Countermeasure 8: Effective Measuring, Monitoring and Oversight***Example 1: LLNL*

The site has dedicated resources working with the functional area managers and the program leads to coach and mentor them through the process of establishing meaningful metrics.

*Example 2: Pantex and Y-12*

As an improvement effort, the MSTS NNSC Contract contained a commitment to reduce "Operational Upsets" by 50% over the base period. While there were some challenges to get alignment on the true definition of operational upsets", the consensus focus area with NNSA is to minimize interruption in delivery of mission which has been a systemic issue in the NSE complex. Interruption in delivery has resulted in idle costs that must be eliminated or reduced in a significant way. Thus, a preventive approach was required to reduce operational upset. MSTS focused on a quality assurance and mission delivery two-prong approach. This resulted in the following areas of focus:

- Technical requirements for the item or Service were analyzed based on three activity types: Engineering, Procurement, and Installation.
- Item or Service Works!
- Quality Assurance requirements to assure technical requirements are met.

- Quality Assurance requirements based on end use of item or service (risk)
- Engineering, project, facility determines technical requirements
- Risk Realized
- Quality Assurance identifies the controls necessary based on the activity
- Issues Management Focus to prevent “Operational Upsets”

The site developed a ConOps metrics suite from benchmarking another site and the nuclear industry. It began with human performance measures and moved to the current suite of CONOPS performance measures/metrics. They perform a periodic deep dive analyses that is used to derive a CONOPS metrics suite for tracking and trending that helps identify potential areas of weakness or opportunities for improvement. Any identified negative trends from the CONOPS metrics suite are then escalated to the appropriate level of management to address.

*Example 2: Consolidated Nuclear Security, LLC (CNS) – Pantex Plant/Y-12 National Security Complex*

The site has developed a unified understanding of disciplined operations that is comprised of multiple systems, processes, and models. The point of the CSN Mission Success Model is that every situation is different. Operations must have the core capabilities such as people, technology and innovation, processes and systems, and the infrastructure required to ensure mission success. The model makes use of CONOPS manuals and a disciplined operations work model.

CONOPS Manuals – The manuals provide a foundation to ensure that management systems are designed to anticipate and/or mitigate the consequences of human fallibility or potential latent conditions and to provide a vital barrier to prevent injury, environmental impact, or asset damage, and ensure mission success.

Disciplined Operations Work Model – this model focuses on the pillars of training, technical procedures, and supervision. These three important pillars are key to working interdependently to execute safe work and ensuring the right culture is sustained along with internal oversight supporting all three.

Training – This is the knowledge, skills, abilities, and experience of the team that is assigned the work. Having qualified people with a validation process is a positive leading indicator. The more training and experience the team has, the less supervision, oversight, and procedural guidance the team needs. This sums up an efficient approach.

Technical procedures – Specific instructions should be followed, should be correct and provide enough detail for newly trained workers to successfully complete tasks safely. The goal is to have the right technical guidance that is both clear and concise. Knowing the qualification level of the audience is imperative. The more detailed the step-by-step guidance given, along with trained and qualified workers, ensures better outcomes. Procedure use and adherence is an integral part of the organizational culture of excellence.

Supervision – Supervisor presence and oversight are imperative to support safe, secure, and high-quality operations. Supervisors need to ensure workers are trained, qualified, and prepared for the task at hand to accomplish the mission. Supervisory presence in the work areas helps establish good working relationships with employees and a positive work culture. It also helps supervisors monitor workers to reinforce good work practices and coach to correct those practices that don't support mission success. Through oversight, supervisors maintain insight into the pulse of the organization and stay apprised of any problems that need to be addressed proactively.



The site uses culture surveys, benchmarking, metrics, and deep dive analysis to define/measure success. They also use an automated dashboard, a disciplined operations plan, a continuous improvement plan, and have created a Disciplined Operations Council.

A culture survey provides a method to assess gaps in organizational performance and help predict future performance through a survey process. The results are a snapshot in time used to measure meaningful elements of the overarching organizational culture to establish a baseline for management on leadership engagement, supervisory support, employee participation, and safety programs and activities, as well as the safety and organizational climate.

Benchmarking other organizations is an integral part of development and growth for any learning organization. It provides an opportunity to compare what is imagined versus work as done. It also allows the opportunity to share best practices or learn from others.

Other tools used include automated dashboards (e.g., Tableau) to monitor performance. This provides a granular look at performance, making metrics transparent and easily accessible. In addition, the data is focused (floor observations, CONOPS events, procedure cycle time, issues management data).

The site uses 4-Pronged Discipline Operations Integrated Plan. The four prongs are enhancement of metrics and performance monitoring, employing a communications campaign/plan, increased field engagement, and procedure improvements. The site additionally devised a Continuous Improvement Plan that is focused on high-risk/high-consequence areas, training, and technology and procedure improvements. Lastly, they created a Disciplined Operations Council which joins the site and NPO into a council focused on operational challenges like tactical and strategic mission and goals, leadership ownership, to escalating CONOPS issues and providing cross-site/organizational collaboration.

## **Appendix 2: Representative Nuclear Industry Perspectives on Assessment and Analysis Results, Successful Practices, and Recommendations for Performance Improvement**

The following offers general perspectives on sources of useful insights from other similar nuclear and high reliability organizations (HROs) that have pursued similar objectives.

### **DNFSB - Defense Nuclear Facilities Safety Board Staff Report April 10, 2022, Review of DOE Safety Oversight Effectiveness (Referenced)**

This report reflects the DOE Organizational complexity and overlapping responsibilities and expectations. The DNFSB, DOE/NNSA Headquarters, DOE-EA DOE Field Offices/Laboratories and Leadership, Contractor/Joint Venture Parent Companies and LLCs all have key Roles, Obligations and Requirements.

Based on the review conducted, DOE should improve its safety oversight approach in Effectiveness Assessments, Staffing, Proactive Safety Oversight, Safety Issues Management.

This report discusses the multiple types of assessments and multiple separate organizations doing the assessments. Compliance, Performance, Specialty ESHQA Internal & external and direct witness of activity or inspection activates, etc.

The effectiveness of the ISMS and CAS systems was a focus and noted that “NPO has a more defined process than the other field offices for evaluating and leveraging CAS effectiveness. NPO evaluates the CAS as its own functional area and rates it on an effectiveness scale from 1-30 with 30 being the least effective.”

This report also notes the EFCOG CAS effectiveness White Paper as a start in joint DOE, Contractor, and Contractor Parent joint Contractor /DOE effectiveness model of joint Contract. This model is included in EFCOG Best Practice 195 (Referenced)

**The EFCOG Board members requested feedback on Leadership’s role in CAS effectiveness. Survey questions were developed using the EFCOG Best Practice #195, “Contractor Assurance System Effectiveness Validation.” Energy Facility Contractors Group, March 2, 2017**

Question: What is currently the greatest challenge to effective implementation of CAS at your site?

- Lack of leadership support and commitment. The old guard, we've always done it this way, prevails and it is not an effective strategy. Leadership is nearly inaccessible - everything is filtered through gatekeepers adverse to making decisions or delivering unpleasant news.
- It is a very siloed approach and not well integrated. Better alignment with management systems and overall assurance is needed to meet mission needs and truly manage performance.
- Getting senior management to prioritize CAS efforts and enforce policies.
- Finding, hiring, and onboarding experienced proficient employees.
- Leadership engagement.

- Siloed information. Each business function maintains assurance information (self-assessments, issues management, etc.) within their own system.
- Only ESH&Q issues are available to all personnel via that enterprise system. The inability of our assessors to access the other business function issues management, cause analysis (if any are conducted), and corrective action information severely inhibits our ability to look for truly systemic issues that might be occurring broadly across the institution.
- Flow down to all levels of the project. CAS is overarching. CAS provides benefits in many areas of program development and improvement. CAS should solicit involvement from the individual contributor all the way up to Senior Management. Are we effective in marketing the benefits of CAS to all employees?

### **DOE EA Office of Enterprise Assessment - Study of Good Practices in Improving Disciplined Operations at Department of Energy Nuclear Facilities - November 2017**

EA reviewed the National Nuclear Security Administration Production Office's Y-12 National Security Complex and Pantex Plant, managed by Consolidated Nuclear Security, LLC (CNS); and Savannah River Site activities managed by the DOE Savannah River Operations Office and Savannah River Nuclear Solutions, LLC (SRNS).

The operational deviations analyzed by the CNS and SRNS organizations suggested that an operational drift – a gradual shift away from adherence to stated organizational standards – typically resulted from not faithfully implementing the work practices that embody the organizational standards developed to ensure safe and compliant work activities. In these nuclear operations, deficiencies in disciplined operations manifested as a series of operational events creating conditions inconsistent with the safety basis.

Management engagement with workers and observation of ongoing work in the field are valuable sources of insight into operational drift because they may reveal behaviors inconsistent with the expected norms, as well as providing opportunities to reinforce behavioral expectations. Documenting and trending management observations and providing coaching opportunities allow the organization to know whether behaviors in the aggregate are shifting away from organizational standards and to determine whether systemic remedial actions may be necessary for organizational change.

When operational performance at a site starts to decline, the usual stated reason is a lack of discipline in the site's work practices. However, organizations often regard such improper practices as discrete events. By solely focusing on the deviation from expectations (or requirements) that closely preceded the event and directing corrective actions at individuals directly associated with the deviation, it is not always immediately evident if latent organizational conditions may have caused or contributed to the deviation. Therefore, the organization's corrective actions may focus only on the actions or inactions of individuals, not on latent conditions or cultural factors. If these conditions and factors remain unaddressed, the organization drifts away from adherence to its stated standards of operation – i.e., operational drift, also called normalization of deviance.

This EA study identified the following four good practices for organizations pursuing improvement efforts to sustain disciplined operations:

1. An improvement strategy and implementation plan are crafted based on senior management's strategic vision, using established and validated organizational improvement models, and communicated and championed by visible senior management ownership.

2. Organizational and individual competencies are developed to observe and analyze operational performance as are considered foundational for continuous improvement of the organization.
3. Local Federal office(s) and the operating contractor act collectively in the improvement approach, recognizing that success depends on engagement of both entities while respecting their proper roles and functions.
4. Enterprise-level processes are used to monitor for operational drift and address performance declines with a goal of preventing those declines from culminating in a significant event.

### **INPO Industry Cumulative Impact Summary Report October 16, 2013**

INPO Industry Cumulative Impact Summary Report October 16, 2013 (Referenced) provides an interesting discovery that was recognized in the ongoing improvement attempts after the Three Mile Island accident. Multiple and overlapping initiatives existed. Some things add complexity rather than increasing effectiveness.

The cumulative impact of improvement initiatives, process controls, and inappropriate behavior norms were impeding plant supervisors and managers from effectively leading their staff. In addition, inefficiencies created by these processes and behaviors challenged the ability of the industry to sustain high levels of plant performance.

This report summarized the actions taken by the industry to reduce the cumulative impact of improvement initiatives, process controls, and inappropriate behavior norms that impede the effectiveness of plant supervisors and managers and detracted resources from more important aspects of plant operation and maintenance. This initiative was started by the industry's chief nuclear officers (CNOs) to address a growing concern that the accumulation of requirements over the years had reduced the efficient management of the industry's nuclear power plants. Many of the CNOs believed this inefficiency had reached the point where sustaining high levels of plant performance is challenged.

The consequences of the accumulation of requirements were apparent from a review that was sponsored by a group of operations executives. This review analyzed how supervisors and managers spent their time in a typical day at a plant. The review identified that first-line leaders spent a large amount of time conducting standardized briefings, attending meetings, and working on program administrative requirements. These items substantially reduced the flexibility and time first-line leaders have for coaching workers.

In response, the strategy outlined in this report was developed. The strategy has two main paths that were implemented in parallel. One path was to improve the behaviors of industry leaders to respond to and address performance issues. The tendency of the industry, including external stakeholders, is to establish process controls, oversight boards, and other administrative requirements to address performance gaps. This tendency has been a main contributor to the accumulation of controls that have been established and are challenging the industry today. This part of the initiative is intended to modify the behaviors of industry leaders and external oversight organizations to address current cumulative impacts and prevent adding new ones.

The second path of the strategy was focused on streamlining processes to enable plant supervisors and managers to have the time and flexibility needed to lead their areas effectively. Process streamlining will also enable the limited station resources to be applied to more important aspects of plant operation and maintenance. Three initial areas were chosen to assess what aspects can be

streamlined, modified, or eliminated. These areas are work management, human performance, and corrective action.

**NNSA – HQ Conduct of Operations Initiative Working Group**  
**Jeffrey M. Haeberlin NNSA - NFO WG Member 11-15-2022 Status Report**  
**EFCOG Best Practice 195: Contractor Assurance System Effectiveness Validation**

There are additional documents and nuclear and high hazard industry good practices from sources such as EFCOG, the Nuclear Regulatory Commission (NRC), the Nuclear Energy Institute (NEI), INPO, NASA, Electrical Power Research Institute (EPRI) and others, which reflect the nuclear industry experience. These sources identify the many barriers and environmental factors that lead to complex organizational conditions which sometimes underestimate latent conditions.

The International Atomic Energy Agency (IAEA) and World Association of Nuclear Operators (WANO) provide useful insights: IAEA provides a model for regulatory expectations and provides oversight, with a shift to ISMs. WANO provides the technical/ operations nuclear expectations including peer checks and support similar to INPO.

In Canada, the Canadian Nuclear Safety Commission's (CNSC's) management system safety and control area (SCA) provides regulatory direction supported by internal expertise in quality assurance, quality management, and management systems, which integrate all aspects of management to assure that licensee requirements for safety are established and applied coherently with other requirements. CSA standard N286-12, Management System Requirements for Nuclear Facilities drives a unified management system approach.

The French provide a more nuclear standardized approach and better materials selection and safety interlocks. Naval Nuclear used the term "Sailor Proof" designs to minimize dependence on administrative systems, which depends heavily on human and organizational controls for assuring performance in both domestic and export of nuclear plant technologies.

## **Appendix 3: Organization and Safety Culture Current Status**

There are many challenges to sustained operational performance due to inherent DOE/NNSA complexity reflected in the multitude of organizations, functions, nuclear and industrial safety and environmental requirements, type of projects, research, and diversity of internal and external oversight and regulatory roles.

Also, rapid changing conditions cause transients that are difficult to plan for, manage, and maintain performance expectations much less improve them. Marketplace conditions, managerial & employee retirements, job changes, new or changing roles all increase risks to expected performance. Project transitions, new assignments, operating contract changes, and constant changing requirements stimulate potential unintended negative performance impacts. Organization and project drift, new technologies, changing business & information systems and the impact of access to remote workers all challenge the culture and overall performance of an organization.

It is important to recognize that performance improvement initiatives outlined in this white paper are being integrated within the well-established existing processes governed through DOE/NNSA regulations and contractual requirements. These requirements focus primarily on Conduct of Operations, (CONOPS), Integrated Safety Management (ISMS), Contractor Assurance System (CAS), Quality Assurance (QA), Training, as well as many overlapping functional area regulations and requirements. Therefore, it is prudent to focus on overall Regulatory, Management, Governance, and Support Systems currently in place and what needs to be done for overall improvement. This approach needs to be done keeping the current culture in mind and in concert with aligning culture in unison with aligning integrated management systems.

### **Comparison of Countermeasures to DOE G 450.4-1C, Attachment 10: Safety Culture Focus Areas and Associated Attributes**

In 2011, experience from the commercial nuclear industry, including the Institute for Nuclear Power Operations, were reviewed for relevant lessons by DOE and EFCOG and outlined in DOE G 450.4-1C, Attachment 10: Safety Culture Focus Areas and Associated Attributes. An analysis of this experience and research over the past decade identified supplemental safety culture elements to help focus attention and action in the right areas to create the desired strong safety culture, promoting a shift from mere compliance toward excellence, continuous improvement, and long-term performance through the original intents of ISM.

DOE and EFOC identified the following three safety culture focus areas and several attributes associated with each one, that they felt offered the greatest potential for achieving excellence in both safety and production performance.

#### **1. Leadership**

- Demonstrated safety leadership
- Risk-informed, conservative decision making
- Management engagement and time in field
- Staff recruitment, selection, retention, and development
- Open communication and fostering an environment free from retribution
- Clear expectations and accountability



## 2. Employee/Worker Engagement

- Personal commitment to everyone’s safety
- Teamwork and mutual respect
- Participation in work planning and improvement
- Mindful of hazards and controls

## 3. Organizational Learning

- Credibility, trust and reporting errors and problems
- Effective resolution of reported problems
- Performance monitoring through multiple means
- Use of operational experience
- Questioning attitude

The core team used the focus areas above as “guiding compass” in addressing the multiple challenges to mission success due to the inherent complexity, diversity, and cross-purpose of priorities within various DOE/NNSA organizations. Thus, the countermeasures herein have strong correlation to the attributes listed in DOE G 450.4-1C, Attachment 10: Safety Culture Focus Areas and Associated Attributes but through the lens of tangible countermeasure actions and good practices for consideration to be utilized “fit for purpose” within respective DOE organizations. Throughout the whitepaper, explicit connection with attributes from DOE G 450.4-1C, Attachment 10 are explicitly noted to emphasize the tie to the core foundation of safety culture improvements in place today with DOE and build on that foundation.

## Understanding Culture

According to the DOE website, **Organizational Culture** is a set of commonly shared beliefs, expectations, and values that influence and guide the thinking and behavior of organizational members and are reflected in how work is carried out. An organization’s culture is the context that drives the choices, decisions, and behaviors of employees from the executive ranks to the individual contributor at the front lines. It becomes the collective identity and personality of the organization, shaping how people within the organization think, feel, and behave.

The organizational culture includes:

- **Beliefs:** Shared understandings and interpretations that influence how employees perceive and make sense of their environment. The belief that safety is a priority for all work is embedded into the organizational culture of DOE, NNSA, and its contractors.
- **Values:** Core principles and beliefs that define what is important and guide decision-making within the organization. Values reflect the organization's aspirations and desired behaviors. Values are typically displayed through all-hands meetings, team-building exercises, recognition ceremonies, and systems where values are reinforced and evaluated (i.e., performance evaluations).
- **Expectations:** Accepted patterns of behavior, written and unwritten rules govern how people should act within the organization. Organizational culture dictates the appropriate avenues of communication, use of language, collaboration, decision-making, and problem-solving strategies encompassed in an enterprise.

- Behaviors: Observable actions and interactions among employees that reflect the underlying cultural values and norms. Behaviors can include teamwork, safety practices, communication styles, leadership approaches, and work ethic.

Organizational culture significantly impacts employee motivation, engagement, and performance. It influences employee interactions, decision-making, and adaptation to change. A strong and positive culture fosters a sense of safety, belonging, collaboration, and innovation, while a negative or misaligned culture can lead to conflict, resistance to change, and decreased productivity.

Organizational culture should be aligned with the risk management approach of the organization. If the culture purports safety as its number one priority, but then rewards a more risk-accepting approach to the conduct of work, the organization will be misaligned to carry out its performance goals. Further, different risks owned or housed in various portions of the organization, which can yield conflict as various risks (production deadline risks, quality risks, legal/reputational risks, safety risks) are set at odds with each other. An integrated and clear approach to organizational risk management, supported by its cultural values and behaviors, is necessary to reduce operational upset potential.

It's important to note that organizational culture is dynamic. Everyone within the system impacts and is impacted by the organization's culture. Organizational culture evolves over time and can be created or changed strategically (with purpose).

### **Importance of Psychological Safety**

Psychological safety is a concept that focuses on the total well-being of the individual in the work environment. When properly implemented it acts as an incubator for innovation and contributes to the bottom-line by decreasing lost time at work and minimizing potential physical safety risks and distractions associated with psychological safety breaches (Leaderfactor, 2020).

Psychological safety is a state of rewarded vulnerability that refers to the belief that one can take interpersonal risks, such as speaking up, expressing ideas, and admitting mistakes, without fear of negative consequences to self-image, status, or career. It is an essential aspect of a healthy and productive work environment because when employees feel psychologically safe, they are more likely to be engaged, innovative, and collaborative with a strong sense of commitment to the organization.

There are several elements that can be easily incorporated into the work environment to foster psychological safety. It is important that a common language and framework is used to positively shape the organizational culture.

Creating a psychologically safe work environment involves several key elements:

- Encourage open communication: Foster an environment where employees feel comfortable expressing their thoughts, ideas, and concerns without fear of judgment or retribution. Actively listen to their input and respond constructively. Provide feedback and ensure to close the loop, even if the answer is no, let the reasoning behind it be known.
- Lead by example: Leaders should demonstrate vulnerability and openness themselves, admitting mistakes and asking for feedback. This behavior sets the tone for employees to feel safe doing the same. It is also important for leaders to make space for all voices to provide input and prevent domination or redundancy in meetings.
- Establish clear expectations: Set clear guidelines for respectful behavior and communication within the workplace. Ensure everyone understands the organization's values and the

importance of treating each other with respect. Be firm about having an environment with zero shame and embarrassment.

- Provide constructive feedback: Feedback should be given in a constructive and supportive manner, focusing on improvement rather than criticism. Encourage a growth mindset where mistakes are seen as opportunities for learning.
- Address bullying and harassment: Create a zero-tolerance policy for bullying and harassment. Take complaints seriously and handle them promptly and confidentially. Speak publicly against bullying and harassment, to communicate the values your team upholds.
- Offer opportunities for skill development: When employees feel competent and capable, they are more likely to feel psychologically safe. Provide training and resources to help employees improve their skills and knowledge.
- Recognize and reward positive behaviors: Acknowledge and celebrate instances where employees model vulnerability by taking risks and contributing their ideas. This reinforces the importance of such behaviors within the organization.
- Promote teamwork and collaboration: Encourage cross-functional collaboration and teamwork, where employees can support and rely on each other.
- Establish trust: Building trust is crucial in a psychologically safe environment. Be consistent, transparent, and honest in your actions and communications.
- Monitor and adapt: Regularly assess the work environment through surveys, feedback sessions, or one-on-one conversations to gauge the level of psychological safety and identify areas for improvement.

It is important to note that creating a psychologically safe work environment is an ongoing process that requires continuous effort, routine assessment, and commitment from all levels of the organization, especially leadership. By fostering an atmosphere of trust, respect, and open communication, employees are more likely to feel comfortable taking risks, being creative, and contributing their best to the organization's success. A psychologically safe environment is one that has a higher rate of retention, better performance, and can successfully navigate the turbulence of the job market with increased innovation and a focus on inclusion.

## **Appendix 4: High Reliability Organizations (from DOE-HDBK-1028-2009, Volume 1)**

Why do some organizations not have as many failures as others? From this question grew the definition and characteristics of High Reliability Organizations (HROs). High reliability organizations are organizations that operate in complex, high-hazard domains for extended periods without serious accidents or catastrophic failures. What distinguishes HROs from other organizations?

- They are organizations that should be successful all of the time continually reinvent themselves
- HROs, decision-making migrates down to the lowest level consistent with decision implementation.
- Systems of organizations operate together to produce risk-enhancing or risk-mitigating outcomes.
- The organizations are committed to learning from everything they do.
- They do not punish people for making honest mistakes.

The key difference between HROs and other organizations in managing the unexpected often occurs in the earliest stages, when only weak signals of trouble are detectable. Weak signals are fragments of information that suggest potential shifts in the foreseeable future. They represent emerging scenarios that can affect your company's operations, business strategy, or competitive landscape. The overwhelming human tendency is to respond to weak signals with a weak response. Mindfulness preserves the capability to see the significant meaning of weak signals and to give strong responses to those weak signals. This counterintuitive act holds the key to managing the unexpected. The five characteristics of HROs that together make up what they term “mindfulness.”

**Preoccupation with Failure** – HROs assess all anomalies, large and small; they treat any lapse as a symptom that something is wrong with the system, something that could have severe consequences if separate small errors happened to coincide at one unfortunate minute. HROs encourage reporting of errors and near misses, they mine and communicate experiences of a near miss for what can be learned. They are wary of the potential liabilities of success, including complacency and the temptation to reduce the margins of safety and drift into automatic processing. HROs are committed to learning.

**Reluctance to Simplify** – HROs take deliberate steps to create more complete and nuanced pictures. They simplify less and see more. They accept the world they face as complex, unstable, unknowable, and unpredictable. They encourage boundary spanners who have diverse experience, skepticism toward receiving wisdom, and negotiating tactics that reconcile differences of opinion without destroying the nuances that diverse people detect.

**Sensitivity to Operations** – This points to the HROs' concern with the unexpected. Unexpected events usually originate in “latent failures”—loopholes in the system's controls, barriers, and safeguards—whose potential existed for some time prior to the onset of the accident sequence, although usually without any obvious bad effect. These loopholes are imperfections in supervision, reporting of defects, engineered safety procedures, safety training, hazard identification, and the like. Normal operations may reveal deficiencies that are “free lessons” that signal the development of unexpected events. HROs do frequent assessments of the safety and health of the organization.

**Commitment to Resilience** – HROs work to reduce errors and keep them small. The hallmark of an HRO is not that it is error-free, but that errors don't disable it. They improvise workarounds that keep the system functioning. HROs put a premium on experts, people with deep experience, special skills, and training. They use flexible, informal ad hoc groups that come together quickly to solve problems and then disband (general uncommitted resources are crucial to resiliency), and HROs mentally simulate worst-case conditions, performing What-If Analysis, essentially anticipating their own equivalent of fire drills.

**Deference to Expertise** – During normal operations, decisions come from the top. During high tempo, abnormal situations, decisions are pushed down and around. So decisions are made on the front line, and authority migrates to the people with the most expertise, regardless of their rank. The pattern of decisions "migrating" to expertise is found in flight operations on aircraft carriers, where uniqueness coupled with the need for accurate decisions leads to decisions that "search" for the expert and migrate around the organization. During times of danger, the predefined emergency structure makes decisions. The key is that members of the organization recognize clear signals for when to switch from one management mode to the other.

HROs maintain reliable performance despite constant exposure to the unexpected, in part by developing and maintaining their capability for mindfulness. A well-developed capability for mindfulness catches the unexpected earlier, when it is smaller; comprehends its potential importance despite the small size of the disruption; and removes, contains, or rebounds from the effects of the unexpected. HROs accumulate unnoticed events that are at odds with what they expected, but they tend to notice these accumulated events sooner, when they are smaller in size. They also concentrate more fully on the discrepancy, its meaning, and its most decisive resolution. Organizations can learn to manage the unexpected better by acting more like an HRO. All organizations accumulate unnoticed events that are at odds with accepted beliefs about hazards and norms for avoiding these hazards. It is these similarities that encourage the transfer of the lessons of HROs to other organizations.

## **Appendix 5: References**

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- 5.2 *NNSA – HQ Conduct of Operations Initiative Working Group Jeffrey M. Haeberlin NNSA - NFO WG Member November 15, 2022*
- 5.3 *EFCOG Best Practice 195: Contractor Assurance System Effectiveness Validation*
- 5.4 *EFCOG WP-SAF-ISM-CAS-002-R0 White Paper Review of Hanford’s ICAS*
- 5.5 *Defense Nuclear Facilities Safety Board Staff Report Review of DOE Safety Oversight Effectiveness April 10, 2022*
- 5.6 *EFCOG Safety Culture Practitioners Resource Guide: A Resource Guide to the DOE Community, 2022*
- 5.7 *EFCOG Best Practice at the Intersection of HPI And WP&C-, 2022*
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- 5.20 *Systems Thinking for Everyday Work (STEW)*
- 5.21 *PNNL Integrated Issues and Risk Management: A Theoretical Framework, November 2022*
- 5.22 *Safety Conversations Catching Drift & Weak Signals-Drift and weak signals (clues to potential incidents) are often hidden. Even when known, strong sociocultural barriers prevent people from talking about them.*
- 5.23 *From Cheese to Stew: Incorporating A Systems' Approach to Critical Incident Analysis*
- 5.24 *Office of Enterprise Assessments – Independent Assessment of DOE Contractors' Management of Safety Issues (Presentation) May 3, 2023*
- 5.25 *DOE/NNSA Letter Responding to DNFSB. Recommendation on a Plan on Improving Safety Oversight*
- 5.26 *Behavioral Science – An Added Tool in the DOE Complex*
- 5.27 *National Training Center Course Catalog <https://ntc.doe.gov/student/course-catalog>*
- 5.28 *IAEA TCS-73, Nuclear Power Human Resource Modeling Tool*

## **Appendix 6: Definitions**

- 6.1 **Conduct of Operations**: The purpose of DOE Order 422.1 “Conduct of Operations” is to ensure that management systems are designed to anticipate and/or mitigate the consequences of human fallibility or potential latent conditions and to provide a vital barrier to prevent injury, environmental impact, or asset damage, and ensure mission success.
- 6.2 **Countermeasures**: For the purposes of this document Countermeasures are Ongoing Initiatives taken to anticipate and/or mitigate the consequences of management systems failures caused by human fallibility or potential latent conditions.
- 6.3 **Error-likely Situation**: A work situation in which the performance-shaping factors are not compatible with the capabilities, limitations, or needs of the worker. In such situations, workers are much more likely to make errors, particularly under stressful conditions.
- 6.4 **Human Organization Performance (HOP)**: HOP is a science-based approach to looking at mistakes so we can address them more effectively. It builds an understanding of how humans perform and how we can build systems that are more error tolerant.
- 6.5 **Human Performance Improvement (HPI)**: HPI is a method of improving performance and outcomes at organizations that can include workplace training but considers reasons for problems beyond just knowledge and skill gaps and interventions other than just training.
- 6.6 **High Reliability Organization (HRO)**: An HRO experiences fewer than anticipated accidents or events of harm, despite operating in highly complex, high-risk environments. HRO is one approach to achieving safety, quality, and efficiency goals.
- 6.7 **Learning Organization**: The theory of organizational learning focuses on the creation of knowledge and the use of that knowledge within an organization. Key aspects of organizational learning theory are that learning happens when people interact while finding and solving problems.
- 6.8 **Operations**: The term “operations” encompasses the work activities of any facility or organization. This includes, but is not limited to, building infrastructure, shop areas, computer centers, scientific research, construction activities, and nuclear facilities operations. It is critical to recognize that “Operational Upsets” can originate in all areas of the enterprise.
- 6.9 **Operational Upset**: An “Operational Upset”, for the purpose of this analysis, is any issue or event that creates a potential loss of operational control, achievement of mission, or undue stress on established management processes that may have adverse safety, health, quality assurance, operational, or environmental implications. This includes unanticipated incidents, pauses, or stop work conditions which may cause delays or negative performance resulting in a threat to mission success.
- 6.10 **Psychological Safety**: The belief that you won't be punished or humiliated for speaking up with ideas, questions, concerns, or mistakes. At work, it's a shared expectation held by members of a team that teammates will not embarrass, reject, or punish them for sharing ideas, taking risks, or soliciting feedback.

- 6.11 Safety Culture: An organization's values and behaviors modeled by its leaders and internalized by its members, which serve to make safe performance of work the overriding priority to protect the workers, public, and the environment.
- 6.12 VUCA: Volatility, uncertainty, complexity, and ambiguity.

**Appendix 7: EFCOG Safety Sub-group, ISM/CAS/QA, Member Contributors**

**Senior EFCOG Leadership**

<b>EFCOG ISM &amp; QA</b>	Omar Cardona-Quiles (SRS)
<b>NNSA Point of Contact</b>	Jeff Haeberlin (NNSA)
<b>EFCOG Senior Sponsor</b>	David Martin, Director Quality/Contractor Assurance (MSTS)

**Task Team Leadership**

<b>EFCOG Task Co-lead</b>	Vince Grosso (MSTS)
<b>EFCOG CAS Co-lead</b>	Norm Barker (BGS)
<b>Planning, Scheduling &amp; Coordination</b>	Kristen Rubino (BNL)
<b>Format &amp; Editing</b>	Barbara Jesus (LLNL)
<b>Editing Team</b>	Kristen Rubino, Michael, Romero, Cheryl MacKenzie, Barbara Jesus

**EFCOG Functional Area Support Leads**

<b>Quality Assurance</b>	Vince Grosso
<b>Contractor Assurance</b>	Norm Barker
<b>Safety Culture</b>	Cheryl MacKenzie
<b>Human Performance Improvement</b>	Mike Petrowski

**Work Planning & Control**

Bruce Stewart

**Contributors by Countermeasure Topic**

**Leadership Engagement and Ownership**

Michael Romero, Norm Barker, Omar Cardona-Quiles

**Supervisor (Front Line Manager) Involvement**

Brian Martin, Chris Hardgrove, Daryl Smoldt, Michael Romero, Joe Sulolisk, James Naylor, Sean Walsh, Bruce Stewart

**Workforce Onboarding, Retention and Proficiency**

Joshua Ramirez, Jeff Warga, Mike Petrowski

**A Learning Organization and Psychological Safety**

Cheryl MacKenzie, Jodi Wilson, Joshua Ramirez, Adrienne King, Mike Petrowski

**Issues Management**

Vince Grosso, Clarisol Villanueva, Maurice Parker

**Risk Management**

Mindy Delong Weetch, Sonya Rutkowski

**Effective Measuring, Monitoring and Oversight for Improvement**

Brian Martin, Chris Hargrove, Vince Grosso