global leadership in **nuclear safety**

WANO

WORLD ASSOCIATION OF NUCLEAR OPERATORS

SOER 2013-1

Operator Fundamentals Weaknesses

Objectives Review

- Discuss the aspects of operator weaknesses that led to SOER 2013-1 '*Operator Fundamentals Weaknesses*'
- Discuss analysis of events, peer review areas for improvement (AFIs) that identified operator fundamental weaknesses as causes and contributors.
- Discuss the purpose of this SOER.
- Discuss the definition of operator fundamentals.
- Discuss the fundament attributes of operator fundamentals.

Analysis of Events

- Analysis of events and their causes identified several underlying reasons for weaknesses in operator fundamentals, including the following:
  - Operators are not sufficiently focused on understanding the technical aspects of the task to complement the use of human performance techniques.
  - An imbalance exists between training on:
    - Task implementation and integrated system knowledge
    - The technical basis for procedures
    - The reasons for operational practices
    - Power plant fundamentals

Analysis of Events

- Risk recognition and mitigation are not effectively used to supplement the requirement to follow approved processes and procedures to ensure activities are completed event-free.
- Training techniques and needs have not been adjusted to account for operators having fewer opportunities to experience plant transients, safety system operation and other abnormal or unusual evolutions because plants in general are operating more reliably.

Causes and Contributing Factors

- An analysis of events, peer review AFIs and industry input indicates the following are some of the more important contributors to weaknesses in operator fundamentals:
  - Operator fundamentals were not clearly defined.
  - An overreliance on processes and procedures promoted a compliance-based approach to a task and a “checklist mentality”.
  - In some cases, operators’ initial and continuing training insufficiently challenges or reinforces operator fundamentals.
  - Management and supervisor monitoring, feedback, reinforcement and coaching of fundamentals were insufficient or ineffective.
  - Plants are operating more reliably; therefore, operators have fewer opportunities to experience large plant transients and complex evolutions, such as reactor trips and startups.

Why a New SOER?

- In the past, industry efforts to improve operator fundamentals resulted in short-term reductions in the number of significant events and reactor trips caused or complicated by weaknesses in operator fundamentals.
- These efforts were not sustained because the actions taken and lessons learned were not well incorporated into operational standards, training and management systems.
- As a result, events caused by weaknesses in use of operator fundamentals continue to occur too frequently.
- Appropriate use of operator fundamentals, combined with the proper use of operating procedures and human performance techniques, could have prevented or mitigated the impact of the events described in this SOER.

Discussion

- Operator fundamentals are defined as the essential knowledge, skills, behaviours and practices that individuals and operating crews need to apply to operate the plant effectively.
- The fundamentals that all operators should demonstrate are as follows:
  - Monitor plant indications and conditions closely.
  - Control plant evolutions precisely.
  - Establish a bias for a conservative approach to plant operations.
  - Work effectively as a team.
  - Have a solid understanding of plant design and system interrelationships.

Discussion

- Monitor plant indications and conditions closely.
  - Monitoring plant indications or parameters requires the full attention of operators. This is true even for operators in plants of more recent design that rely more on digital screens and comprehensive alarm systems to monitor the plant status.
  - Operators need to maintain an overall picture of plant conditions. It is important for operators to understand which are the key parameters to monitor.
  - Monitor and determine reactor and plant statuses following reactor power changes or during activities with a potential to affect reactor safety.

Discussion

- Control plant evolutions precisely.
  - Accurate operating guidance, deep knowledge of integrated system operations and theory, use of human performance error prevention tools and attention to the task are essential in ensuring precise plant control.
  - Operators are also expected to fully understand and anticipate the plant's response to actions, remain focused on the task and know what to do if an unexpected response occurs.
  - Operators need to implement all four attributes of the human performance tool STAR (stop, think, act, review), with special emphasis on T (think) and R (review).

Discussion

- Industry operating experience has shown two recurring problems regarding the use of procedures and human performance tools.
  - Operators followed procedures exactly as written, but did not adequately understand the evolution or have the necessary knowledge to know how the plant should respond to the situation or condition.
  - Many events have occurred when operators did not follow procedures as written, implemented evolutions with no procedure guidance or did not use human performance techniques properly to support procedure use.

Discussion

- Operate the plant with a conservative bias.
  - Conservatism is a bias for action in the direction of plant safety and includes maintaining a sufficient safety margin. This behaviour also avoids challenging the plant and shows a clear desire to protect the reactor core.
  - Managers declare and strongly support the policy to act conservatively, as it applies to reactor safety, through frequent communication and reinforcement of this approach to operators.

Discussion

- Work well as a team and communicate effectively, particularly during abnormal or emergency situations.
  - The fundamentals discussed previously are more effective when operating crews work together as a team. Effective teams include a thoughtful balance of backgrounds, experience, technical knowledge and personalities.
  - Communication is an important aspect of teamwork. Members of crews should communicate clearly and regularly to share important information and clarify priorities.
  - Effective command and control and oversight are critical to good teamwork. Control room supervisors must use available resources thoughtfully to ensure operators correctly prioritise their actions to mitigate an event.

Discussion

- Have a detailed understanding of plant design, system and component interactions and applicable theoretical or engineering principles.
  - Operators should have a thorough understanding of the basis for their actions and the expected system response to those actions. They should pair their knowledge of system interactions with the procedural guidance provided to ensure successful outcomes.
  - The applied science and engineering principles behind plant operations are understood and refreshed on a regular basis, including reactor physics, thermodynamics and electrical theory.
  - Behaviours and practices should promote a detailed understanding of plant design, engineering principles and sciences.

Recommendations

- This SOER establishes actions to help members to self-assess the effectiveness of operator fundamentals and training programmes at their stations.
- The recommendations of this SOER are intended to address the causes and contributors and lead to effective, sustainable corrective actions.

Recommendation 1

- Conduct a self-assessment of the operations training programmes using '*Self-Assessment Guide: Assessing Training Effectiveness in Addressing Operator Fundamentals*', May 2011, to understand fully the effectiveness of training on the subject of operator fundamentals. Develop corrective actions based on the results of the self-assessment to improve the quality of operator fundamentals training.

Recommendation 2

- Perform a self-assessment of operator fundamentals using '*Self-Assessment Guide to Operator Fundamentals*', June 2011, to identify gaps that could cause events or reduce crew effectiveness when responding to a transient. Use the results of the self-assessment to develop corrective actions designed to better focus training and coaching of operators on identified weaknesses.

Recommendation 3

- Implement the following organisation and leader behaviours and practices to establish and reinforce operator fundamentals.
  a. Clearly define, communicate and make readily available for operator reference '*Your Role in Operator Fundamentals*'.
  b. Ensure initial and continuing training for operators provides them with a thorough understanding of plant design, engineering principles and sciences to complement task requirements. Ensure methods, such as open-ended questioning, discussions, walkdowns and dynamic learning activities are used to establish, refresh, reinforce and test this knowledge.

Recommendation 3 (Continued)

c. Actively monitor and engage operators to improve the application of their fundamentals through in-field coaching. Ensure active monitoring includes the following goals and attributes:

- Make changing behaviours the primary objective, with capturing and trending data a secondary, but still important objective.
- Include thorough, probing inquiries or questions as part of any observation to assess the operator's level of attention on the task, thinking process, level of task understanding and state-of-mind. Pre-job briefings provide an excellent opportunity to gauge an operator's knowledge of an upcoming task. In addition, observe visible behaviours, such as having the procedure in-hand, self-checking and placekeeping.
- Promote, reinforce and reward behaviours that support a culture of understanding on how the plant works and why it works that way. Encourage the use of a questioning attitude and reward conservative decision-making.
- Build in follow-up activities to ensure identified gaps are addressed in a timely manner and are shared across crews and departments to promote learning and improvement.

Recommendation 3 (Continued)

d. Ensure individuals in the operations line of responsibility (for example, shift manager, operations manager, plant manager and site vice president) actively monitor key operator fundamental activities at an appropriate frequency. This would include activities, such as reactivity changes, field operator rounds, crew responses to simulated transients, surveillance tests and infrequently performed tasks.

e. Ensure operator performance is closely reviewed after significant plant transients and trips to identify potential weaknesses in behaviours, knowledge and practices.

Recommendation 4

- Establish and maintain training and programmes that support effective control room teamwork.
  a. Training should include the importance of staying in your assigned role, of challenging other team members who do not meet the intent of their roles or who step out of their role and of working together to control and monitor the plant effectively.
  b. Crew composition assignments for each operating team should be structured such that there is a good mix of new and experienced operators on each crew with complementary backgrounds and personalities.
  c. Ensure members of a newly constituted crew train together before assuming control room duties, and evaluate personnel returning from lengthy off-shift assignments before they resume control room duties.
  d. Ensure the shift manager leads, sets high standards, encourages the crew members to be critical of their performance and develops timely and effective actions to continuously improve crew performance.

Recommendation 5

- To ensure sustainability of the above actions, use corrective actions, performance indicators and self-assessments to identify, track and trend the effective application of operator fundamentals.

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Any questions?