Safety culture and NCNR leadership accountability

Accountability of leadership for safety culture

Though a healthy nuclear safety culture depends on everyone in an organization, the leadership has a singular role in setting the tone for that culture. NIST Center for Neutron Research (NCNR) leadership has a fundamental responsibility for the safe operations of the NIST reactor. Leadership deficiencies at the NCNR, including complacency that affected the nuclear safety culture, were factors in the circumstances that led to the February 3, 2021, event.

As identified by the Event Response and Corrective Action Subcommittee[1], the seven root causes that led to the incident on February 3 were:

1. Change management was insufficient.
2. There was inadequate management oversight of refueling staffing.
3. There was a culture of complacency in reactor operations and a lack of staff ownership of continuous improvement.
4. Training and qualification program for operators was not on par with programmatic needs.
5. Procedures as written did not capture necessary steps to assure latched elements.
6. Procedural compliance was not enforced.
7. Inadequacies existed in the fidelity of latch determination and tools.

Accountability for these root causes and the responsibility for implementing measures to address them resides with the licensee – the NCNR Director – and with the leadership within the Reactor Operations & Engineering (ROE) Group, including the Chief of Reactor Operations & Engineering (CROE), Chief of Reactor Operations (CRO) and Chief of Reactor Engineering (CRE). This accountability follows from the licensee's responsibility for the safety of the public and environment. Within the NIST organization, the accountability follows the NIST management chain beginning with the NIST Director. The NIST Director holds the NCNR Director accountable for effective leadership of the NCNR, including the safe operations of the reactor.[2] The NCNR Director holds the CROE accountable for effective leadership of the ROE group and the safe operations of the reactor. Accountability flows from the CROE to the CRO and CRE and then to the reactor crew chiefs and supervisors.

NIST promotes a philosophy that accountability for failure is best achieved when the responsible individuals recognize that failure and each makes a choice to take personal ownership through active participation in the incident response, restoration, and resolution. With that in mind, each supervisor – from Crew Chief to the NCNR Director – has been held accountable for the incident in three ways. (1) leading critical aspects of the reactor recovery effort, (2) contributing to the transparent and comprehensive root cause analysis (developing a fundamental understanding of the circumstances and conditions that led to the February 3 incident), and (3) actively participating in implementation of the corrective actions. An illustrative example of the third element is that the training on Human

[1] Safety Evaluation Committee Subcommittee: Event Response and Corrective Action, *Review of the NCNR Event Response and Technical Working Group Root Cause Analysis and Corrective Action Plan*, August 12, 2021.
[2] The NCNR Director reports to the NIST Associate Director for Laboratory Programs (ADLP) and the ADLP reports to the NIST Director. Therefore, the NCNR Director is accountable to the NIST Director via the ADLP.

Performance/Error Prevention Tools and Procedure Use and Adherence was designed, developed, and delivered by several RO supervisors as well as RO staff. All ROE staff – including leadership – attended the training as participants.

Senior NCNR leadership has been held accountable specifically as follows.

In the aftermath of the incident, the NIST Director assigned responsibility and authority to the NCNR Director for (1) determining what caused the incident through a comprehensive review of the circumstances, (2) developing a set of corrective actions that will prevent recurrence of the incident, (3) implementing the corrective actions, (4) restoring the reactor to operational readiness to restart once authorization from the NRC is granted, (5) providing frequent communications to NIST stakeholders on the status of the reactor and progress toward restart, and (6) verifying the effectiveness of the corrective actions. The NCNR Director has demonstrated his accountability for the incident to the NIST Director by leading the items above and providing weekly progress updates to the Director's Office via the NIST Incident Response Team (IRT). The NCNR Director is co-chair of the NIST IRT for the reactor incident, which meets weekly and is attended by members from across NIST, including the Chief of Staff from the NIST Director's Office. The NIST Director will continue to hold the NCNR Director accountable for these actions until they are complete. As part of his on-going accountability, the NCNR Director will provide the NIST Director with an annual report on the safe operations of the reactor, including an update on the continuing development of the nuclear safety culture in Reactor Operations (discussed later in this document).

The NCNR Director assigned specific responsibilities to the CROE including (1) convening and leading a technical working group to analyze the incident, determining the causal factors, contributing factors, and root causes, and formulating a set of corrective actions to prevent recurrence; (2) developing a detailed, resource-loaded implementation plan for the corrective actions; (3) leading the ROE group in executing the corrective action implementation plan; (4) leading the reactor recovery effort to restore the reactor to operational readiness; (5) providing the Nuclear Regulatory Commission (NRC) with all requested information on the incident to support the NRC's Special Inspection of the incident; and (6) assisting the NCNR Director with communications to the NRC related to the incident. The NCNR CROE has demonstrated his accountability to the NCNR Director by making significant progress on the items above. The NCNR Director will continue to hold the CROE accountable for restoration of the reactor, implementation of the corrective actions, and restarting the reactor safely. The CROE will also be responsible for several new critical leadership actions and program improvements described in the next section.

A common thread among the seven root causes of the incident was the state of the nuclear safety culture. Fostering and maintaining a healthy nuclear safety culture – indeed fighting complacency – is perhaps the biggest challenge. This complacency remained as the staff attrition required transition to a new, less experienced crew. The key to addressing this challenge to fight complacency is developing a sustainable culture that incorporates actions, procedures, and practices that ensure attention to detail. Complacency can set in over time, and gradually erode aspects of the safety culture. Changing the safety culture takes place over years, not months. It requires a sustained effort as well as periodic monitoring of the working environment. Ensuring a sustained healthy nuclear safety culture is the responsibility of

the NCNR Director and all managers in ROE. Since there is no single simple action that leadership can take to strengthen the safety culture, the approach that NCNR leadership has adopted is to take numerous actions with the goal of transforming normative behaviors to those found in a healthy nuclear safety culture. The attributes and behaviors found in a healthy nuclear safety culture are described explicitly in the Institute of Nuclear Power Operations publication, *Traits of a Healthy Nuclear Safety Culture* (INPO 12-012[3]). Note that a key element of this culture change will be determining if the actions are effective. Therefore, the safety culture within ROE will be assessed periodically and the data analyzed to identify trends and/or issues. Any actions that are identified to address concerning trends will be tracked by the new Corrective Actions Subcommittee of the NCNR Safety Evaluation Committee. Responsibility for dispositioning the corrective actions resides with the CROE.

Specifically, the NCNR Director has committed the organization to several leadership actions and program improvements designed to normalize the behaviors found in a healthy nuclear safety culture at the NCNR. These actions are either already complete, are in progress, or are planned. In addition to the corrective actions already described in the corrective action implementation plan, NCNR leadership is instituting several program improvements. These actions and program improvements are presented in the next section as they align with the attributes identified in the Traits of a Healthy Nuclear Safety Culture.[3]

Leadership actions to improve the safety culture
(**CA** = corrective action, **PI** = program improvement, **EAP** = existing activity or program)

Increase frequency and quality of field presence
Examples of this include:

- All personnel with supervisory responsibilities in ROE, from Crew Chiefs to the NCNR Director, are expected to engage ROE staff consistently and frequently in the workplace, mentoring in the field, with an emphasis on discussions of safe operations. Such engagements are expected to include presence at shift turnovers. Effectiveness of the supervisor's engagement with staff in safety conversations will be judged by his/her direct line supervisor.[4] **(PI)**
- ROE leadership will engage in an enhanced Management Observation Program (MOP). Expectations of conduct of observations will be clarified in Maintenance Procedure 1.2. Effectiveness of a supervisor's management observations will be judged by their supervisor. **(PI)**
- The CRO or designee will perform procedural compliance audits in the field weekly. Effectiveness of the CRO's audit program will be judged by the CROE. **(PI)**

Nuclear safety is constantly examined
Examples include:

[3] Pocket Guide to INPO 12-012: Traits of a Healthy Nuclear Safety Culture, Institute of Nuclear Power Operations (2013).
[4] The supervisor uses the NIST performance management system as the formal mechanism to set work expectations and performance standards, monitor performance, rate the employee, and reward good performance. The performance management system also includes mechanisms for addressing performance that fails to meet standards.

- The NCNR Director will institute a periodic assessment of the nuclear safety culture, starting with a baseline assessment of the ROE staff in the next several months.[5] The assessment will be used to identify trends and/or issues in the culture that could affect reactor operations safety. Any actions identified to address concerning trends will be tracked by the new Corrective Actions Tracking Subcommittee. Note that status of safety culture assessment will be part of the planned annual reactor updates that the NCNR Director will provide to the NIST Director. **(PI)**
- The NCNR Director will continue to convene a Safety Assessment Committee (SAC), which provides an annual independent review of reactor operations, reactor engineering and industrial safety at the NCNR, as is required by the NIST research reactor (called the NBSR) technical specifications. The safety culture assessment results will be shared with the SAC.[6] **(EAP, PI)**

Improve communication of importance of safety
Examples of this commitment include:

- The CRO has established weekly discussions with ROE on the 10 traits of a healthy nuclear safety culture highlighting specific examples of recent NCNR operational activities and how they relate to each of the traits.[3] **(PI)**
- The CROE will lead safety culture discussions with RO staff *using real-world examples based on operating experience at the NCNR* as an essential part of initial qualification training and requalification training. **(PI)**
- The NCNR Director addressed all NCNR supervisors and presented his expectations regarding safe work practices and provided suggestions for improving safety culture and fighting complacency. The Director will continue to discuss safety culture periodically with all staff and emphasize the important role supervisors have in leading safe operations, especially through staff engagement. Specifically, the NCNR Director will encourage and expect supervisory engagements with ROE staff on identification of vulnerabilities, staff ownership, and development and implementation of solutions. **(EAP, PI)**
- The NCNR Director will continue to discuss safety developments and updates at the monthly NCNR safety management meetings with NCNR senior leadership, industrial safety personnel, and radiation safety personnel. *Safety culture, particularly in ROE, will be a standing agenda item*. **(EAP, PI)**
- Safety issues are being more fully integrated into the development of procedures including mandating more robust use of the NIST Hazard Review and Approval system and more fully incorporating NCNR safety staff into review of procedures. **(PI)**

Provide incentives, rewards, and sanctions that are aligned with nuclear safety
Examples include:

- The NCNR Director recently established a Safety Good Catch Award that recognizes staff who do something positive to prevent something bad from happening (e.g. injury or damage to equipment). Note that this is different from near-miss reporting.[7] Recipients are acknowledged in several ways, including in a facility-wide communication by the NCNR Director. **(PI)**

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[5] Baseline assessment is anticipated to be complete by end of CY2021.
[6] Expected for the SAC review in CY2022.
[7] NCNR participates in the NIST near-miss reporting program.

- Compliance with safety requirements and fostering a healthy nuclear safety culture are incorporated into each employee's performance plan and evaluated by employee's supervisor. **(EAP, PI)**

Make a strategic commitment to safety
Examples of this commitment include:

- The NCNR Director has established a Corrective Actions Tracking (CAT) subcommittee of the NCNR Safety Evaluation Committee (SEC). The SEC CAT subcommittee will monitor and report the corrective actions resulting from any internal or external committee or panel charged with evaluating or reviewing any safety aspect of operating and managing the NBSR. **(PI)**
- The CROE is responsible for (1) identifying new corrective actions to the SEC CAT, (2) disposition of the corrective actions, and (3) providing status updates to the SEC CAT on progress towards completion of corrective actions. The NCNR Director will monitor ROE's progress towards completion of the corrective actions. **(PI)**
- The CROE has directed the CRO and RO staff to examine critically all reactor operations procedures for completeness and revise them so that they comply with industry best practices for use and adherence. **(PR-CA1, PR-CA2, PR-CA3, PR-CA4, PR-CA4, PR-CA5, PR-CA6, PI)**
- ROE management will establish a permanent training rotation shift for operators and require staff participation and ownership in continuous improvement programs. Effectiveness of the new shift and its impact on training and continuous improvement will be assessed by the CRO and CROE.
- The NCNR Director will provide annual updates to the NIST Director on the status of the reactor safety program including updates on all corrective actions and the most recent assessment of the nuclear safety culture within the ROE group. **(PI)**

A change management system is implemented that ensures that changes are evaluated and implemented such that nuclear safety remains a priority
Examples include:

- The current approach to change management by ROE will be formalized and expanded into a flexible framework. The CROE is responsible for developing this framework to ensure that any changes that have the potential to affect safety of reactor operations are reviewed and managed deliberately. **(MS-CA1)**
- The framework will be expanded beyond tracking procedure changes, experiments, parts, instruments, reactor structures, systems, and components to include staffing changes and matters that directly or indirectly affect crew proficiency and mechanical tool effectiveness. The CROE, CRO and CRE will be responsible for the deployment and effective use of the framework for all matters that affect safe reactor operations. **(MS-CA1, MS-CA2, MS-CA3)**
- The CROE will elevate the Aging Reactor Management (ARM) program so that the ARM manager will report to the CROE. The ARM program will be appropriately prioritized to ensure strong communications exist across the RO and RE groups and any issues are identified and resolved in a timely manner. The CROE will be responsible for an effective ARM program, including setting priorities and allocating resources based on program deliverables. **(MS-CA4)**

Roles, responsibilities, and authorities are clearly defined to ensure nuclear safety

Examples include:

- ROE leadership is clarifying the roles and responsibilities of all ROE personnel and line management and the administrative rules (AR) are being revised to reflect this clarification, including the following Admin Rules that form the basis for reactor operations activities:
    - AR 1.0: Conduct of Operations,
    - AR 1.1: Human Performance Tools, and
    - AR 5.0: Procedure Use and Adherence.
- Reactor supervisors' training will be modified to emphasize and strengthen the oversight role and supervisory responsibilities of reactor supervisors. The effectiveness of the training program, that of the training coordinator, and the effectiveness of the oversight training will be assessed by the CROE and CRO via observations of the supervisors. **(MS-CA5)**

Leadership demonstrates behaviors that set the standard for safety

Examples of this include:

- In addition to all ROE staff, all ROE leadership, from Crew Chiefs to the NCNR Director, participated in the ROE training on procedure use and adherence and human performance tools. This training will be required for all operator trainees in the future. The CROE, CRO, and CRE will judge the effectiveness of the training in the future to ensure that programmatic goals of the training are being met and nuclear safety remains the overriding priority. **(PR-CA6)**
- Leadership will engage ROE staff frequently, seeking out opinions and concerns from staff regarding plant operations and other matters that could affect plant safety. The effectiveness of supervisory engagement of staff will be judged by ROE leadership and the NCNR Director. **(PI)**