Technical Conscience Principle
OPEX Review

Functional Group: Engineering

Technical Conscience Principles Affected:
Principle 4: Quality

- Engineers and technical staff recognize that systematically applying critical thinking, verification techniques, and additional reviews ensure high-quality products and decisions to minimize the likelihood of errors and omissions. Technical inputs, methodologies, and the bases for engineering results are documented, independently verified, and formally communicated to appropriate stakeholders.
- Engineers and technical staff demonstrate a deep personal commitment and obligation to ensure plant conditions and proposed changes are appropriately bounded by requirements of plant design and licensing basis and preserve operating, design and safety margins

Description of Event:

In April, 2018, during startup from a refueling outage, Braidwood Unit 1 SCRAMMED due to a turbine "anti-motoring" trip. The anti-motoring trip, requiring at least 2 of 3 pressure switches to actuate on low delta-pressure, was caused by two independent degraded conditions: (1) the low-pressure sensing line, common to all three pressure switches, was inadvertently blocked by a weld repair inside the main steam line, and (2) the equalization valve for one of the 3 pressure switches failed.

The blockage was a known issue and was scheduled to be repaired in the outage immediately prior to the SCRAM. The blockage was discovered shortly after startup from an outage in 2015: another pressure indicator on the same low pressure sensing line read 0 psig at 75% power. Engineering personnel did not identify that the blocked sensing line affected the anti-motoring differential pressure switches sharing that line.

The repair was removed from the scope of the 2018 outage due to the cost and outage duration impact of the repair.

Gaps:

The engineering review of the scope deletion lacked systematically applied critical thinking. Plant drawings should have been used to systematically identify all affected instruments on the affected sensing line, and to determine the potential consequences of the functional loss of those instruments.

Expected Behaviors:

Engineers should have a deep personal commitment to ensure degraded plant conditions are appropriately bounded by requirements of plant design and licensing basis and preserve operating, design and safety margins.

How/Where can this Technical Conscience Principle be used at Exelon?

Engineers reviewing items in CAP should consider the potential consequences of the condition, and communicate significant issues to appropriate stakeholders.

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Description of Event:
In June, 2018, Braidwood SCRAMMED during a technical specification surveillance. A newly modified OVATION digital control system, interconnected to the older analog 7300 control system, unexpectedly tripped a main feedwater pump during the surveillance. The cause of the SCRAM was a design error: the design team failed to consider all the online surveillance testing functions, and the modified circuit, which should have only lit a test light for a successful test, actually tripped the pump. The original and final circuit contained a variable resister that needed to be adjusted to compensate for the changes in the circuit. The overall circuit impedence changed, but the variable resister setting was not changed to compensate for that impedence change.

Gaps:
The design team failed to determine in detail all of the normal functions of the circuit. The team did consider the normal operating functions and the accident functions, but not the online testing functions. This omission led to gaps in the design and post modification testing.

Expected Behaviors:
Engineers must demonstrate a deep personal commitment and obligation to ensure proposed changes to the plant are appropriately bounded by requirements of plant design, normal operation, accident conditions, online maintenance and surveillances.

How/Where can this Technical Conscience Principle be used at Exelon?
Engineers preparing configuration changes including modifications, temporary configuration changes, equivalent changes, and item equivalecies.

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Technical Conscience Principles Affected:
Principle 5: Challenging Plant Conditions

- Nuclear professionals communicate the bases for advocated positions, avoiding opinions and emotional arguments. They clearly communicate to decision makers the assumptions, judgments, analysis limitations, potential consequences of advocated positions, and the probabilities of undesired outcomes.
- Nuclear professionals proactively present technical considerations and functional expertise to decision makers, insist on conservative decisions related to nuclear safety, and, if needed, escalate concerns to appropriate members of management. They understand that decisions regarding plant reliability should be based on facts and appropriate consideration for potential risks and may not always result in selecting the most conservative option.

Description of Event:
Calvert Cliffs Project Management requested that corporate Design Engineering perform a technical challenge for the heavy lift plan for the main generator stator.

The corporate engineer identified gaps in the design and test plan for the lift. The consequences of a rigging failure could lead to the permanent shutdown of one or both Calvert Cliffs units. The generator stator weighs approximately 1 million pounds.

The site team challenged the corporate review, stating that due to the unique design of the rigging device, the standards did not apply. A redesign and test of the rigging system could result in considerable cost and outage delays.

The corporate engineer escalated the concern to corporate management, and ultimately, the site and corporate leadership agreed to a rigging redesign and test. The sponsorship provided by the site and corporate leaders prevented any outage delays, and there were additional costs incurred. Ultimately, the generator lift occurred event free.

Positives:
The corporate engineer clearly communicated the to the decision makers the potential consequences and applied his expertise to ensure appropriately conservative decisions were made regarding the design and test of the rigging system.

Expected Behaviors:
The corporate engineer avoided opinions and emotional arguments. The engineer elevated the issue in a timely fashion, which helped preserve a success path (without outage delay) that met the appropriate margins.

How/Where can this Technical Conscience Principle be used at Exelon?
One of the most common applications for these principles would be for Outage Scope Deletions: it is important to communicate the potential consequences of deferring an activity from an outage.

Technical Conscience Principles
Supplemental Material

Functional Group: Engineering

Warning Flags

The following behaviors should serve as warning flags that Technical Conscience Principles need to be used to ensure plant activities are being conducted in a manner that is consistent with plant design and licensing basis, that ensures high reliability, and that preserves operating, design, and safety margins.

Warning Flags	Expected Behaviors
Engineer submits Tech Eval with no references	Engineers use factual information to provide recommendations and evaluations. This information is verified as part of the review process. (TCP #4)
Scope of task is not clearly defined	Engineers should challenge the requester to confirm a clear and mutual understanding of the scope of the assigned task. (TCP #5)
Procedure does not strictly apply to the current condition	Engineers are expected to STOP, and discuss with supervisor and appropriate experts to confirm whether we can proceed without changing the procedure or applying other compensatory actions. (TCP #2).
The assigned task can affect a component that is classified as OPCC	Methodical evaluations or analyses are used to ensure full understanding of potential consequences of the technical concern and probabilities for undesired outcomes. (TCP #3)
The assigned task is first of a kind or first in a while for the assigned team	Input from subject-matter experts and personnel with specialized knowledge – such as in operations, maintenance, engineering, chemistry, radiation protection, emergency preparedness or nondestructive examination – are used. (TCP #3)
The assigned task might result in foreign material in any system, especially the reactor	The team is expected to apply appropriate HU-AA-1211 behaviors. (TCP #4).
Significant technical expertise is coming from a single induvial, whether internal or external	Engineers and technical staff recognize the limits of their technical expertise and clearly communicate this to decision makers. The team should consider a third party review. (TCP #4).