NEI CCF Tabletop Part 1

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Tabletop Example – Chiller Controls

- The new chiller controls were selected due to extensive successful operating history and reliability in the commercial world with modern multi input control algorithm that has extensive operating history in an existing application that is not inherently special.
- Both the chiller controls and chillers are being replaced. The HVAC air handling units are separate from the chillers and are not being replaced.
- Chiller replacements would significantly improve MCR HVAC reliability. Several reliability improvements have been designed into the digital control system such as:
  - Freeze protection which are not available in old analog systems.
  - Elimination of manual actions required to restart chiller if power is lost more that 60 seconds.
  - Time delay for compressor restart to prevent cycling on power interrupts (allows time for power stability).
  - A design that will allow the chiller to operate in a limited condition when certain process values enter off-normal conditions and still provide cooling.
  - Variable anti-cycle time based on how long the chiller was running prior to stopping and how long the chiller has been stopped.
- Existing chiller controls are 1970 vintage are obsolete and required significant maintenance to maintain.

Chiller Function and Description

- MCR Chillers are a safety related support system that maintains safety related equipment below the plant's 104°F (40°C) mild environmental qualification limit.
- Exceeding the 104°F limit would result in long term equipment reliability issues and discomfort to the MCR Operators.
- Chillers function is only to make chilled water
- The digital controls are independent from the HVAC fan controls.
- One train of chillers is in operation at all times with the other train in standby and neither train is affected by ESFAS actuation.
- Plant design basis for the chillers does not require diversity. All units are of the same design and MCR chillers are common to two units.

A Similar Chiller Controls Upgrade and Performance Improvements

- Similar chiller controls at a sister plant have been operating in a safety related application for more than 10 years without any problems. Those chiller upgrades were performed under 50.59.
- Plant operating experience demonstrates that the digital controls have significantly improved system reliability in both the areas of failure to run and failure to start.
- These similar digital controls at the sister plant are now obsolete (uP is no longer available) and need to be upgraded to next generation boards due to the lack of spare parts but upgrade costs are $2.5 million plus the present day licensing uncertainty is preventing the upgrade route.

Problem and Resulting Direction

- Installation has been placed on hold due to uncertainty on the technical and regulatory approach utilized. The uncertainty is around the applicability of the inspection guidance in BTP 7-19 to auxiliary support systems and in addressing the risk from common cause failure to the satisfaction of the NRC inspector.
- NRC BTP 7-19 provides only two solutions to prevent CCF
  - 100% testing which is not achievable (design occurred when exhaustive testing was the requirement) and
  - Diversity is not practical
- Because of the lack of clarity of the scope of BTP 7-19 and the limited methods dealing with CCF, as well as the onerous ISG-06 process, submittal to the NRC for approval would create unnecessary cost and schedule impacts as well as regulatory uncertainties associated addressing CCF make the project unfeasible.
- Direction is now to use chillers with first of a kind analog controls which are expected to not be as reliable or efficient as the digital controls.

Failure Impact

- UFSAR description is two independent safety related trains with a supporting FMEA based upon electrical and mechanical failures and no CCFs.
- Chillers are not modeled in new NUREG 1.200 PRA (low safety significance) and they are not an AOO or PA initiator
- A loss of both train chillers (i.e., CCF) results continued circulation of outside air or re-circulated air for a MCR isolation. Outside ambient is rarely above 100^{o}F during the hottest summer conditions.
- There is an analyzed heat up calculation that demonstrates that there is a significant time delay in reaching the 104^{o}F limit even during the hottest summer conditions.
- Accident conditions do not result in additional heat loads and ESFAS actuation does not change the chiller operation. It continues to produce 45^{o}F chilled water from river water.
- Maintenance procedures in place to troubleshoot and recover failed units.

Q&A?