

## NEI Examples

### Use of COL License Conditions to Address Significant Errors in a Referenced Design Certification

#### Three Examples based on AP1000 Experience

##### Proposed License Condition for Hydrogen Venting Inside Containment

##### **Hydrogen Venting Inside Containment:**

The AP1000 Containment Hydrogen Control System (VLS) is not a safety-related system, but has a function to limit the hydrogen concentration in containment following severe accidents (considered beyond-design-basis events) so that containment integrity is not endangered. Hydrogen released to lower containment following certain severe accidents is considered to vent into containment areas where it can be burned off in a controlled manner by hydrogen igniters. Analyses of the controlled burn of hydrogen were based on a previous design of vent path locations and hydrogen source terms. Hydrogen burn analyses and associated ITAAC describing acceptable vent locations were not updated consistent with the current design and construction tolerances were not considered. Changes are required to update the certified AP1000 design description, associated ITAAC, and hydrogen burn analyses to reflect the current design for ensuring that ignition of postulated hydrogen releases through vent paths will not challenge containment integrity for applicable beyond-design-basis events. Design changes requiring reanalysis are listed as follows:

1. Hydrogen source and vent path opening areas and locations described in AP1000 DCD Revision 19 and ITAAC Table 2.3.9-3, Item 3(iii), and
2. Larger hydrogen source term consistent with the AP1000 design.

While changes are required to ensure compliance with containment combustible gas control requirements in 10 CFR 50.44(c), they reflect the type of deviations that can be identified in the process of completing the detailed design and supporting analyses for construction. The deficiencies in the current design analysis do not require physical modifications to any plant SSC, and do not represent a significant safety concern or a significant hazard consideration during construction, because required corrective actions are well understood and can be reliably implemented. A License Condition that clearly defines necessary Tier 1 design description, ITAAC, and analysis corrections can be written and would be effective to ensure the final design and constructed facility satisfies regulatory requirements.

##### **PROPOSED LICENSE CONDITION:**

After a Combined License is issued, the licensee shall, prior to closure of ITAAC 2.3.9, Item 3(iii), (1) process departures from the Generic DCD based upon an updated analysis using computational fluid dynamics (CFD) that demonstrates that postulated combustion of hydrogen releases through as-designed room source and vent path openings will not challenge containment integrity; and (2) obtain a license amendment that:

- (1) Corrects Tier 1 ITAAC Table 2.3.9-3, Item 3(iii) to reflect the departure, and
- (2) Revises Tier 2 wording to reflect the departure

## Proposed License Condition for Main Control Room Dose

### **Main Control Room Dose:**

NRC regulations require that the AP1000 Main Control Room (MCR) design comply with 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 19. Changes to the certified AP1000 design and associated limiting conditions for operation are required to ensure that radiological conditions in the MCR are maintained within regulatory limits during design basis accident conditions. Design and setpoint changes are required to address errors in the AP1000 certified design. Design errors identified during translation of the certified design into construction/design documents are listed as follows:

1. AP1000 electrical penetrations do not include supplemental shielding assumed in the original main control room radiological dose analysis,
2. The original MCR radiological dose analysis did not include direct dose contributions from radioactive material assumed to accumulate on MCR normal HVAC system (VBS) and emergency habitability system (VES) filters during design basis accidents,
3. The original MCR radiological dose analysis did not consider direct dose contributions from radiation streaming through MCR wall penetrations,
4. The original main control room radiological dose analysis used non-conservative initial condition assumptions for the main steam line break design basis accident analysis, and
5. MCR ventilation instrumentation and control setpoints were not conservatively established for bounding conditions.

While the design changes are required to ensure compliance with GDC-19 requirements, they reflect the type of errors that can be identified in the process of completing the detailed design and supporting analyses for construction. The deficiencies in the current design do not represent a significant safety concern or a significant hazard consideration during construction, because required corrective actions are well understood and can be reliably implemented. A License Condition that clearly defines design and analytical deficiencies, corrective action acceptance criteria, and affected SSCs can be written and would be effective to ensure the final design and constructed facility satisfy safety requirements.

### **PROPOSED LICENSE CONDITION:**

After a Combined License is issued, the licensee shall, prior to closure of ITAAC 2.2.5, Item 7e), process departures from the Generic DCD and obtain a license amendment that:

- (1) Update Tier 2 to reflect the GDC 19-compliant MCR design, accounting for:
  - a) Supplemental shielding in control room electrical penetrations.
  - b) direct dose contribution from ventilation system filter shine,
  - c) conservative initial conditions for the design basis main steam line break accident analysis,
  - d) completed, as-designed shielding details, and
  - e) revised MCR ventilation instrumentation and control setpoints for bounding conditions.
- (2) Apply methodology established in Regulatory Guide 1.183 "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors, Revision 0, 7/00, to the update of the MCR design.

**Compliance with IEEE 603-1991:**

IEEE 603-1991 is a standard for safety systems incorporated by reference in 10 CFR part 50.55a(h). Clause 6.6 of the standard establishes requirements for "Operating Bypasses." All of the protective actions initiated by the AP1000 Protection and Safety Monitoring System (PMS) comply with the criteria of IEEE 603-1991 Clause 6.6 with the exception of the PMS arrangements for blocking the source range neutron flux doubling logic input to the Boron Dilution Block. The PMS does not comply with the requirement to impose permissive conditions on block of the flux doubling logic, nor is logic included to reinstate permissive conditions or actuate the necessary protective functions when the conditions are not met.

Design changes required to ensure compliance with IEEE 603 are identified as follows:

1. Add a new permissive to permit blocking the flux doubling logic during reactor startup.
2. Add logic to isolate potential boron dilution sources if the flux doubling logic is blocked with reactor temperature is less than the new permissive, and reset the logic if potential sources are not isolated. An additional reset of source range flux doubling logic will be added when RCS temperature falls below the new permissive.
3. Include the new permissive and actuation in Technical Specifications, and describe the changes in Tier 2 information.

While changes are required to ensure compliance with IEEE 603 requirements in 10 CFR 50.55a(h), they reflect the type of deficiencies that can occur in the process of completing the detailed design and supporting analyses for construction. The deficiencies in the current design do not represent a significant safety concern or a significant hazard consideration during construction, because required design changes are well understood and can be reliably implemented. A License Condition to confirm the implementation of the design that clearly defines the correction of design deficiencies can be written and would be effective to ensure the final design and constructed facility satisfies safety requirements.

**PROPOSED LICENSE CONDITION:**

After a Combined License is issued, the licensee shall, at least two years prior to the 10 CFR 52.103(g) finding, process departures from the Generic DCD and obtain a license amendment that ensures compliance with IEEE 603 requirements in 10 CFR 50.55a(h) with respect to the blocking of the source range neutron flux doubling logic input to the Boron Dilution Block. The departures and license amendment shall:

- (3) Modify the design to add a new permissive and associated logic to the boron dilution block logic and logic to force isolation of potential boron dilution sources during shutdown conditions.
- (2) Revise Tier 2 wording, figures and tables to reflect the design change.
- (3) Revise Technical Specifications to reflect the new PMS permissive and logic changes.