Issue List for Public Meeting Discussion
Mechanical Engineering Branch (contact: Jason Huang)

DCD Tier 2, Section 3.9.4

1. Are the functional requirements of the APR1400 CEDM identical to those of the first production tests, i.e. 76.2 cm/min for maximum stepping speed and 159kg for design drive line load, as described in FSAR Section 3.9.4.4? If not, what are they? Also, in DCD Section 3.9.4.1, it states that the design duty requirement for the CEDM is a total cumulative CEA travel of 30,480 m (100,000 ft) operation without loss of function. The staff requests the applicant to clarify the basis of the design duty requirement of 100,000 ft of travel. This information is necessary to complete the area of review described in SRP 3.9.4, Item I.1, which states that "[t]he descriptive information, including design criteria, testing programs, drawings, and a summary of the method of operation of the control rod drives, is reviewed to permit an evaluation of the adequacy of the system to perform its mechanical function properly."

Yes, the functional requirements of the APR1400 CEDM are identical to those of the first production tests. Design duty requirement of 100,000 ft of travel was determined by operation experiences.

2. The staff requests the applicant to update the Figure 3.9-7, "Control Element Drive Mechanism" to clearly indicate the components that form the pressure boundary, including the motor housing assembly. This information is necessary to complete the area of review described in SRP 3.9.4, Item I.1, which states that "[t]he descriptive information, including design criteria, testing programs, drawings, and a summary of the method of operation of the control rod drives, is reviewed to permit an evaluation of the adequacy of the system to perform its mechanical function properly."

Figure 3.9-7 will be updated to clearly indicate the pressure boundary components as attachment 1

3. The staff requests that the applicant reference in the DCD the codes and standards used for the motor assembly and extension shaft assembly as described in Table 3.2-1, Item 11a(2) and (3). This information is necessary to complete the area of review described in SRP Section 3.9.4, Item I.2, which states that "[t]hose portions that are not part of the RCPB are reviewed for compliance with other specified parts of Section III, or other sections of the ASME Code ".

Codes and standards for the motor assembly and extension shaft assembly were not described because safety function of those components is limited to scramability, which was verified by testing as described in the DCD section 3.9.4.4

4. The applicant should include in the DCD the design margins for non-pressure boundary components. This information is necessary for the staff to make a finding under SRP acceptance criterion 2.C in SRP Section 3.9.4: "For nonpressurized equipment (Non-ASME BPV Code): Design margins presented for allowable stress, deformation, and fatigue should be equal to or greater than margins for other plants of similar design with successful operating experience. A justification of any decreases in design margins should be provided."

In the DCD section 3.9.4.4, the second paragraph describes the design margin for non-pressure boundary component as follows; "~ The CEDM was operated for a total travel length of 47,854 m (157,000 ft) with no abnormality, which is about 1.5 times the design duty requirement."

5. DCD Section 3.9.4.4 discusses changes to the material of the motor housing lower end fitting and thickness of the upper shroud tube, but does not discuss how these changes affect the 60-year life of the CEDM, as the changes are stated to improve structural integrity (from material change) and mechanical strength (thickness change). The changing of materials and thickness may result in changes to loads such as deadweight and changes to the pressure housing could affect its safety function as a pressure boundary. Also, 3.9.4.4 discusses operating experience as providing design verification of the APR1400 CEDM. The applicant should provide additional detail on how the referenced operating plants have provided verify design verification of the changes as mentioned above to the motor housing lower end fitting and upper tube shroud?

1) The structural integrity of the pressure housing is evaluated by fatigue analysis for its 60-years life. The design changes are considered in the evaluation. The evaluation result is described in the CEDM Summary Stress Report (APR1400-H-N-NR-14006-P,) which will be supplied to the NRC when completed at the end of June.

2) DCD section 3.9.4.4 concerns operational assurance, which focuses on performance of the active components such as motor assembly and ESA. So, 'operating experience as providing design verification of the APR1400 CEDM' in the DCD section 3.9.4.4 was stated with regard to the active components. The motor housing lower end fitting and upper tube shroud are not active components so the operating experience statement does not apply to the design changes made to the motor housing lower end fitting and upper tube shroud.

6. SRP acceptance criterion 4 in SRP Section 3.9.4 states that "[t]he operability assurance program will be acceptable provided the observed performance as to wear, functioning times, latching, and ability to overcome a stuck rod meet system design requirements." DCD Section 3.9.4.1.1.2 states that clearances in the motor assembly enable the CEDM to avoid stuck rod condition, which is verified by the tests described in Subsection 3.9.4.4. However, DCD Section 3.9.4.4 does not explicitly state where the ability to overcome a stuck rod is verified. Additional information in the DCD on the ability to overcome a stuck rod is necessary for the staff to make a finding under this SRP acceptance criterion.

The DCD Section 3.9.4.4 does not explicitly deal with the ability to overcome a stuck rod. But the acceleration life time test and drop test were described, and those tests are regarded as verification of the ability to overcome a stuck rod because those tests show that the CEDM operates properly without rod stuck during such the severe tests. DCD Section 3.9.4.4 will be revised as attachment 2.

DCD Tier 2, Section 5.2.1.1

7. Codes and standards are not consistently stated throughout the DCD. The control element drive mechanism (CEDM) for example is listed as "ASME Section III Class 1" in Table 5.2-1, yet is listed as "ASME Section III NB-2007 with 2008 addenda," in Table 3.2-1 (9 of 86), item 11a. Designations should be checked across the DCD and cited with a consistent level of specificity, such as ASME BPV Code Section III or ASME BPV

Code Section XI. Additionally, please clarify this statement in DCD Section 5.2.1.1, “The components and code classes that are listed in Table 5.2-1 are in accordance with the provisions of 10 CFR 50.55a with this exception: the applicable ASME Code edition for the APR1400 is the 2007 Edition with 2008 Addenda.

The designations and level of specificity for a table in DCD may be different from those of other tables according to the purpose of the table. The purpose of Table 5.2-1 is to identify component codes (i.e., applicable ASME Code Class) and code editions/addenda required by 10 CFR 50.55a for each RCPB component.
For consistency with Table 3.2-1, Table 5.2-1 will be revised to have a separate column "Codes" with, for example, "ASME Section III NB" to be consistent with Table 3.2-1 as shown in attachment 3. “Primary component supports” will be deleted because the table is for RCPB components and the supports themselves are not RCPB. “RCP auxiliaries” will be revised to be specific. “ASME Section III NC” and “Class 2” are added for “Pipe and valves”.
The phrase "with this exception" in the statement will be deleted because it is unnecessary.