Response to Action Item 19-157 Section 19.1

PRA Issue List Regarding APR-1400, DCD Tier 2, SECTION 19.1

Issue # PRA-150 (AI 19-157)

Section 19.1.5.3.2.1 of APR1400 DCD Rev. 0 states that “[a]ll of the significant events that contribute to CDF are flooding events in the auxiliary building. Furthermore, all the events that contribute to CDF are breaks that are larger than the design basis break.” The breaks that are larger than the design basis break were not identified and it is not clear why the design basis break is smaller than these breaks.

Response

The DCD Section 19.1.5.3.2.1 is revised as shown in Attachment.

Impact on DCD

The DCD will be revised as stated in the response.

Impact on PRA

There is no impact on the PRA model.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

Attachment – Section 19.1.5.3.2.1 DCD Markup for Question PRA-150

[Section 19.1.5.3.2.1, Page 19.1-161]

19.15.3.2.1 Flooding Initiating Events

Significant flooding initiating events that contribute to the CDF and the LRF are shown in Table 19.1-64 and Table 19.1-65, respectively.

All of the significant events that contribute to CDF are flooding events in the auxiliary building. ~~Furthermore, all the events that contribute to CDF are breaks that are larger than the design basis break.~~ The vast majority of initiating events that contribute to internal flooding core damage risk are caused by breaks in the fire protection system.

The largest contributor to CDF is a large fire protection system break in Quadrant B. This event begins with a break that propagates to and causes failure of Train B electrical equipment. Accumulation of water causes failure of the door between Quadrants B and D and the subsequent surge of water causes loss of Train D electrical equipment. Failure of secondary cooling and failure of equipment needed to support feed and bleed cooling result in core damage.

Response to Action Item 19-231 Section 19.1

PRA Issue List Regarding APR-1400, DCD Tier 2, SECTION 19.1

Issue # PRA-208 (AI 19-231)

During the event tree review, the staff noticed that when the RCS was intact, flow from an AFW pump and one atmospheric dump valve appeared to be credited. Technical Specifications do not require an AFW pump to be operable during Mode 4 (hot shutdown) unless the SGs are relied upon for decay heat removal. Without a Technical Specification, it is unclear how the applicant would justify the availability of AFW and the atmospheric dump valve during Modes 4 and 5 with RCS intact and SCS in operation.

Response

Technical Specifications 3.7.4 already requires secondary relief capacity in Mode 4. In parallel, Technical Specifications 3.7.5 requires one AF train, with a motor driven pump, to be available in Mode 4. These Technical Specifications can be revised, or an administrative requirement can be added, to extend the availability requirement to Mode 5 when the RCS is intact.

Note that the PRA can take credit for non- Technical Specifications equipment as well as credit for systems which do not have Technical Specifications during certain modes. Lack of Technical Specifications does not mean the system is unavailable. The LPSD PRA incorporates the unavailability of the AF pump trains based on an assumed outage schedule. In conclusion, the Technical Specifications play no role in determining the availability of components in PRA.

Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA calculations.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.

Response to Action Item 19-243 Section 19.1

PRA Issue List Regarding APR-1400, DCD Tier 2, SECTION 19.1

Issue # PRA-220 (AI 19-243)

Containment event tree quantification results shown for internal events containment bypass on Figure 4-1 of APR1400-K-P-NR-013604-P, “APR1400 Design Certification Probabilistic Risk Assessment: Full Power Level 2 PRA: Quantification Notebook,” Revision 0, July 2013, does not agree with the value provided in Figure 3-1. Using the values provided in Figure 3-1, the staff calculated a total frequency of containment bypass, which consists of PDS 1 through 4, to be 6.43E-8 /ry (2.41E-8 + 4.01E-8 + 1.18E-10 + 0.0E+00 /ry). In contrast, Figure 4-1 shows frequency of containment bypass as 7.75E-8 /ry.

Both Figure 4-1 and DCD Figure 19.1-49 show a containment bypass frequency as 5.9% of CDF (DCD Figure 19.1-49 shows only percentage containment failure frequency values.).

Response

PDS 1 and 2 are sequences with SGTR initiating events, and PDS 3 and 4 are ISLOCA sequences. All four are included to the Containment Bypass frequency shown in Figure 4-1 of APR1400-K-P-NR-013604-P and Figure 19.1-49 of the DCD. However, the Containment Bypass frequency in these figures also includes the severe accident- induced SGTR frequencies from PDSs 5 through 108.

For example, PDS 86 involves high RCS pressure and a dry SG, and therefore has the potential for induced SGTR. As shown in Table 4-1 of APR1400-K-P-NR-013604-P, the conditional probability of a bypass (due to induced SGTR), given PDS 86 conditions is 0.0902. The induced SGTR (I-SGTR) frequency of PDS 86 is calculated as follows.

Induced SGTR Frequency (for PDS 86)

= Frequency (for PDS-86) * Conditional I-SGTR probability (for PDS-86)

= 1.19E-07 /ry * 0.0902

= 1.07E-08 /ry

Level 2 CET is a systematic calculation tool to quantify the containment bypass frequency including both sequences initiated by SGTR and induced SGTR sequences. The total bypass frequency of 7.75E-08 /ry is the quantification result including induced SGTR frequency from all the PDSs.

The DCD is revised to clarify the meanings, as shown in Attachment 1.

Figure 4-1 of APR1400-K-P-NR-013604-P is revised as shown in Attachment 2 to clarify that induced SGTR is included.

Note: Attachment 2 is placed in the electronic reading room.

Response to Action Item 19-243 Section 19.1

Impact on DCD
The DCD will be revised as stated in the response.

Impact on PRA
There is no impact on the PRA. However, Figure 4-1 of APR1400-K-P-NR-013604-P will be revised as stated in the response.

Impact on Technical Specifications
There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports
There is no impact on any Technical, Topical, or Environmental Reports.

Attachment 1 – Figure 19.1-49 DCD Markup for Question PRA-220

[Figure 19.1-49, page 19.1-1418]

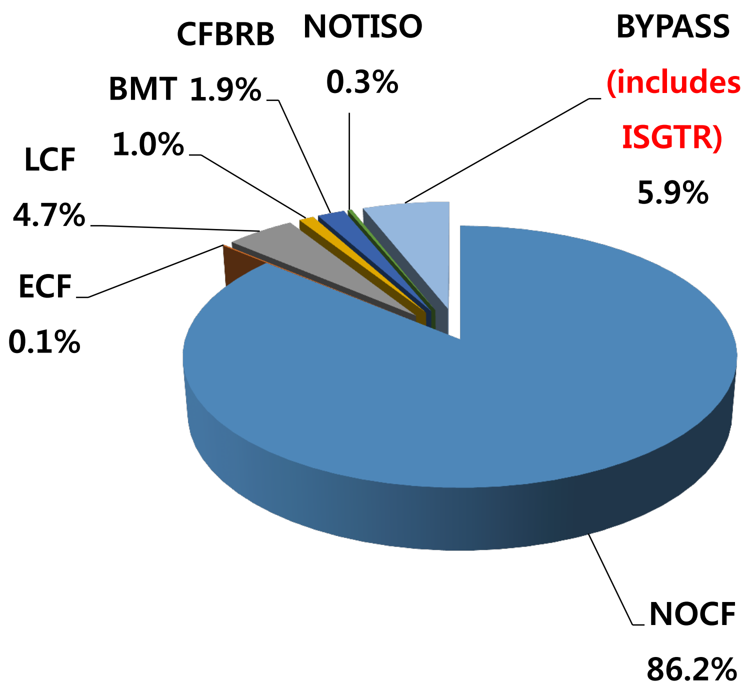

Figure 19.1-49 CET Quantification Results for Internal Events

Response to Action Item 19-249 Section 19.1

PRA Issue List Regarding APR-1400, DCD Tier 2, SECTION 19.1

Issue # PRA-226 (AI 19-249)

The MAAP calculations documented in APR1400-K-P-NR-013603-P for Source Term Categories 17 and 21 differ by the hole size assumed. Cases STC17 and STC21 assume 0.1 ft2 and 1.0 ft2 hole sizes, respectively. However, the iodine release fraction for STC21 is 400 times larger than for STC17. In addition, the shapes of the curves for CsI and CsOH are different between STC17 and STC21. The shape of these two curves for STC17 suggests a release of material already airborne in containment at the time of containment failure, while the shape of these two curves for STC21 suggests a release of material that becomes airborne after containment failure. Please explain these differences.

Response

The release fractions are not expected to be directly proportional to the area of the break in containment. Flow restrictions of the gases and fission products in the very small break area (0.1 ft2) would be expected to significantly reduce the release fractions when compared to the larger break size. Consistent with the other release category evaluations, the MAAP code was utilized to predict the release fractions for the two break sizes, and the factor of approximately 400 difference was the result.

In both STC-17 and STC-21, containment failure occurs at 61.9 hours (2.2E+5 seconds), and some fission products are released at that time. However, in the case of STC-21, the significantly larger flow of containment gases out of containment results in a significantly larger release of material that becomes airborne after containment failure. When comparing the CsI plots of STC-17 with STC-21, the scale of the y-axis must be considered. The STC-21 plot does have a release of fission products that were airborne at the time of containment failure, but it is not as obvious as the plot in STC-17 because of the >2 orders of magnitude difference in the scale of the plots. As noted in the comment, the much greater portion of the releases for STC-21 occurs in the hours after containment failure, when there is a significant flow of gases out the break in containment.

Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Reports.