REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**424-8532**
SRP Section:	**19.05 – Aircraft Impact Assessment**
Application Section:	**19.5**
Date of RAI Issue:	**03/01/2016**

Question No. 19.05-2

In accordance with 10 CFR 50.150(a)(1), each applicant listed in paragraph (a)(3) shall perform a design-specific assessment of the effects on the facility of the impact of a large, commercial aircraft. Using realistic analyses, the applicant shall identify and incorporate into the design those design features and functional capabilities to show that, with reduced use of operator actions:

(i) The reactor core remains cooled, or the containment remains intact; and

(ii) Spent fuel cooling or spent fuel pool integrity is maintained.

In addition, 10 CFR 50.150(b) requires that the FSAR contain a description of the design features and functional capabilities and how the design features and functional capabilities meet the assessment requirements.

To ensure compliance with 10 CFR 50.150, the staff requests that the applicant address the following:

a. DCD Tier 2, Section 19.5.4.1, lists key components inside containment; however, it neither adequately describes the design features and functional capabilities nor, alternately, references the associated DCD section. The applicant is requested to ensure that the design features are adequately described in DCD Tier 2, Section 19.5, or a reference to the associated DCD section exists.

b. DCD Tier 2, Section 19.5.4.2, item d, states the properties of concrete and reinforcement bars protect key design features in the auxiliary building; however, it does not discuss other buildings or structures which are also credited for protecting key design features (e.g. emergency diesel generator building). The applicant is requested to verify and confirm that the DCD contains a complete list of structures or buildings credited for protecting core cooling equipment, or spent fuel pool integrity.

c. DCD Tier 2, Section 19.5.4.2, item e, states that the location of the AAC GTG, as shown on Figure 1.2-1, is a key design feature for limiting the loss of electrical power to key safety systems; however, Figure 1.2-1 is a high-level sketch of the site arrangement and does not provide an accurate representation of the separation distance required to protect the AAC GTG. The applicant is requested to provide a description, in the DCD, of the separation distance necessary to protect the AAC GTG and its components.

   DCD Tier 2, Section 19.5.4.4, lists the AAC GTG as a key design feature for providing power to various equipment; however this system is neither adequately described nor, alternately, references the associated DCD section. The applicant is requested to ensure that this non-class 1E power source is adequately described in DCD Tier 2, Section 19.5, or a reference to the associated DCD section exists.

d. DCD Tier 2, Section 19.5.4.4, describes support equipment and systems necessary to maintain core cooling; however, it is not clear to the staff whether the essential chilled water system, the ultimate heat sink, or others are missing from DCD Tier 2, Section 19.5.4.4. The applicant is requested to verify and confirm that the DCD contains a complete list of key design features credited for core cooling.

e. NEI 07-13 states that the effects of smoke can greatly affect the ventilation systems and diesel generators. It is not clear to the staff whether the AIA included the effects of smoke on ventilation, diesel generators, or other components such as cooling towers, as discussed in NEI 07-13. The applicant is requested to confirm that the AIA accounted for these smoke effects and the DCD is appropriately revised.

Response – (Rev. 1)

a. Section 19.5.4.4 states that the design of the SI and SC systems(DCD section 6.3 and 5.4.7), AFW systems(DCD section 10.4.9), MSSVs(DCD section 10.3.2.2.3), MSADVs(DCD section 10.3.2.2.4), and charging and auxiliary charging pumps(DCD section 9.3.4) are key design features, including reference to applicable DCD sections to describe those systems. This includes portions of those systems within the RCB. Section 19.5.4.4 will be revised to add the following statement to include the RPV and associated reactor coolant system components within the RCB: “The design of the RPV and associated reactor coolant system components located in the RCB as described in Sections 5.3 and 5.4 are key design features."

b. The emergency diesel generator building and the auxiliary building are the two buildings of concern credited for protecting key design features. Section 19.5.4.2 Item b states that the EDGB location and design as described in Section 3.8.4 are key design features. The minimum structure requirements as shown in Table 3-2 of NEI 07-13 are presented with the existing AB by adding EDGB in Section 19.5.4.2. The Turbine Building and Compound Building were considered in the AIA. These buildings were excluded from the structures which require a detailed AIA since these structures do not contain any key safety feature and are not of sufficient reinforced concrete construction, as described in section 6.2 of the AIA report. The CCW HX and ESW buildings were also considered in the AIA because these buildings have key safety features. These buildings do not require further analysis since these are separated from each division

by distance and at least one division still has a safety function such as decay heat removal in the event of aircraft impact, as described in section 6.1.4 of AIA the report.

c. A statement will be added to Section 19.5.4.2 item e to state that the AAC GTG building will be located at least 100 yards from the auxiliary building. The AAC GTG is described in DCD section 8.4.1.3.

d. The AIA assessed essential chilled water, and the ultimate heat sink, and concluded that these were not required. Thus, the DCD already contains a complete list of key design features credited for core cooling.

e. The separation between the electrical divisions is adequate to preclude the failure of both electrical divisions due to smoke or other AIA impacts. This will be added to Section 19.5.4.2.

Impact on DCD

The DCD will be revised as indicated on the Attachment.

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 Report.

19.5.4.1 RCB and SFP

The RCB, as described in Sections 3.8.1 and 3.8.2 and shown on Figures 3.8-1 and 3.8-2 is a key design feature for the protection of the safety systems located inside containment from the impact of a large commercial aircraft. The assessment concludes that a strike upon the RCB would not result in the perforation of the containment, such as to cause direct damage or exposure to jet fuel of the systems within the containment.

The assessment also determined that key ~~safety-related~~ components located inside the RCB, including the reactor pressure vessel, steam generators, reactor coolant loop piping, pilot operated safety relief valves, control element drive mechanism, the safety injection and shutdown cooling system suction line motor operated valves, discharge line check valves and instrumentation and control equipment associated with core cooling are unaffected by shock-induced vibrations resulting from the impact of a large commercial aircraft.

The location and design of the control element drive mechanism described in Sections 3.9.4 and 4.6, with the control element drive mechanism located inside of the RCB on top of the reactor vessel closure head such that upon loss of internal power distribution the control rods drop into the reactor core by gravity, are key design features for ensuring that the reactor will be tripped following the impact of an aircraft.

Regarding the SFP, the assessment determined that there are no aircraft impact scenarios that result in leakage from the SFP below the required minimum water level. The pool liner is not perforated and all SFP piping attachments are configured such that they will not allow water in the SFP to drain below the minimum water level. The design and location of the SFP and its supporting structures as described in Sections 3.8A.2 and 9.1.2 are key design features for protecting the integrity of the SFP such that an impact of a large commercial aircraft would not result in leakage from the SFP below the required minimum water level.

19.5.4.2 Plant Arrangement

The APR1400 plant design and arrangement of major structures described in Section 1.2.14 and Figures 1.2-1 through 1.2-27 are key design features. Specifically, the assessment credited the arrangement of, and design of, the following building features to limit the location and effects of potential aircraft strikes on the RCB and AB in the following locations:

a. The location and design of the Auxiliary Building (AB) structure as described in Section 3.8.4 are key design features in protecting the RCB [ ] from the impact of a large commercial aircraft. Additionally, portions of the AB provide protection of the RCB on the northeast, northwest and southwest sides [ ].

including

b. The location and design of the EDGB as described in Section 3.8.4 are key design features ~~in~~ protecting portions of the east wall of the AB [ ] from the impact of a large commercial aircraft.

core cooling

c. The physical separation of the east and west EDGs, as described in Section 8.3, Figure 1.2-14 and Figure 1.2-21, is a key design feature in limiting the loss of electrical power to key ~~safety~~ systems from the impact of a large commercial aircraft.

and EDGB. These properties meet the minimum requirements for physical damage rule sets as shown in Table 3-2 of NEI 07-13 Revision 8.

d. Properties of concrete and reinforcement bars, as described in Appendix 3.8A, are key design features in protecting key ~~safety~~ equipment in the AB.

e. The location of the AAC GTG as shown on Figure 1.2-1 relative to the EDGs is a key design feature in limiting the loss of electrical power to key safety systems from the impact of a large commercial aircraft.

The AAC GTG building will be located at least 100 yards from the auxiliary building.

19.5.4.3 Fire Barriers and Fire Protection Features

and EDGB

The design and location of 3-hour fire barriers, including fire doors, penetration seals and dampers ~~that separate the safety divisions~~ within the AB are key design features for the protection of ~~safety-related~~ core cooling equipment within these buildings from the impact of a large commercial aircraft. The assessment credited the design and location of fire barriers (including doors) as depicted on Figures 9.5A-1 through 9.5A-11 to limit the effects of internal fires created by the impact of a large commercial aircraft. In addition, certain fire barriers, including doors, fast-acting blast dampers and penetration seals, are credited for 5 psid. These 5 psid barriers are identified on Figures 9.5A-1 through 9.5A-9. These key design features ensure at least one complete train of secondary heat removal equipment and necessary support systems to include cooling water, electrical power supply and distribution, and instrument and control within the AB and EDGB is available to provide core cooling following the impact of a large commercial aircraft.

f. The separation between electrical divisions, specifically EDGs, is adequate to preclude the failure of both electrical divisions due to smoke effects.

The EDGB contains key design features and functions for emergency AC power, such as the emergency diesel generators and associated components.

19.5.4.4 Core Cooling Features

The design and physical separation (by fire barriers as described in Section 9.5A) of the safety injection and shutdown cooling system (described in Sections 6.3 and 5.4.7), of the auxiliary feedwater system (described in Section 10.4.9), of the main steam safety valves and main steam atmospheric dump valves (described in Sections 10.3.2.2.3 and 10.3.2.2.4) and of the charging pumps and auxiliary charging pump (described in Section 9.3.4) are key system design features for assuring core cooling following a reactor trip in response to an aircraft impact event. The design of the RPV and associated reactor coolant system components located in the RCB as described in Sections 5.3 and 5.4 are key design features.

The design and physical separation of the component cooling water system (CCWS) (described in Section 9.2.2), of those portions of the essential service water system located in the ESW Building (described in Section 9.2.1), of the Class 1E electrical power supply and distribution system (described in Section 8.3), and of the safety-related instrumentation and control system (described in Chapter 7) including the physical separation between the MCR, RSR and the RCC and the ability to power the SI pumps, charging pumps, CS pumps and SC pumps from the AAC GTG are key supporting system design features for assuring core cooling following a reactor trip in response to an aircraft impact event. The action of tripping or shutting down the reactor ensures that the fuel in the reactor is kept subcritical. (described in section 8.4.1.3)

Following shutdown from power operation, core cooling is maintained by the auxiliary feedwater system as described in Section 10.4.9. Primary system is maintained at operating pressure and temperature by adjusting auxiliary feedwater flow to match the decay heat rate from the reactor core. Heat is discharged to the atmosphere using the main steam safety valves or main steam atmospheric dump valves. Under these conditions, additional boration is unnecessary to maintain subcriticality.

In the event CCW RCP seal cooling is unavailable, the capability of the chemical volume and control system to provide seal-water flow to the reactor coolant pump seals described in Section 9.3.4.2.1 is a key design feature. In the event both CCW RCP seal cooling and RCP seal injection are unavailable, the capability to maintain RCS inventory with the SI system and to remove containment heat using the containment spray pumps and heat exchangers as described in Section 6.2.2 is a key design feature. The auxiliary feedwater system is available to provide decay heat removal.