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## 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.: 264-8243  
SRP Section: 06.02.05 – Combustible Gas Control in Containment  
Application Section:  
Date of RAI Issue: 10/22/2015

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### **Question No. 06.02.05-6**

10 CFR Part 50 (c)(3) Equipment Survivability. Containments that do not rely upon an inerted atmosphere to control combustible gases must be able to establish and maintain safe shutdown and containment structural integrity with systems and components capable of performing their functions during and after exposure to the environmental conditions created by the burning of hydrogen. Environmental conditions caused by local detonations of hydrogen must also be included, unless such detonations can be shown unlikely to occur. The amount of hydrogen to be considered must be equivalent to that generated from a fuel clad-coolant reaction involving 100 percent of the fuel cladding surrounding the active fuel region.

Containment integrity depends on hydrogen control and mitigation because hydrogen burns can create short but extreme temperature conditions in containment. The systems and components required to establish and maintain safe shutdown and containment structural integrity following a severe accident are identified in DCD Tier 2, Table 19.2.3-4, "Systems and Equipment/Instrumentation Required for Equipment Survivability Assessments." This table currently includes the passive autocatalytic recombiners (PAR), and the hydrogen igniters (HI) from the hydrogen mitigation system. Maintaining the physical integrity of the piping penetration assemblies, including the penetration seals, is required to maintain containment integrity. The piping penetrations, including but not limited to the seals, should also be added to the list of containment penetrations in Table 19.2.3-4.

In the equipment survivability analysis described in DCD Tier 2, Section 19.2.3, credit is taken for maintaining the containment pressure below the factored load category of 123 psia, per DCD Tier 2, Section 19.2.4.2.3, by relying on the emergency containment spray backup system (ECSBS). See DCD Tier 2, Figure 19.1-3, Simplified Diagram – Containment Spray System. This is a single train system, with its own dedicated ECSBS spray ring header and an inside containment isolation check valve, V1014. This backup spray function is the basis provided for limiting the equipment survivability analysis to 24 hrs, as stated in DCD Tier 2, Section 19.2.3.3.7.2, "Determination of Severe Accident Environmental Conditions." This valve should

be shown to meet the equipment survivability conditions, including surviving a hydrogen burn and remaining open. This valve should be added to DCD Tier 2, Table 19.2.3-4.

Please confirm that all of the check valves shown in DCD Figure 19.1-3, Simplified Diagram – Containment Spray System, are depicted correctly to indicate the direction of flow. Check valves V1014, V1008, and V1007 appear to be shown in an inconsistent direction as compared to V101 and V100. Adding flow direction arrows below the check valve symbol, as done in DCD Tier 2, Table 6.2.4-1, would provide clarification.

As part of your response, please revise all the affected DCD text, tables, and figures accordingly.

## **Response**

In the event of a severe accident, the piping penetration assemblies are required to function in order to maintain containment integrity. Therefore, DCD Table 19.2.3-4 will be revised to include 'Mechanical Penetration Assembly,' as shown in Attachment 1 to this response.

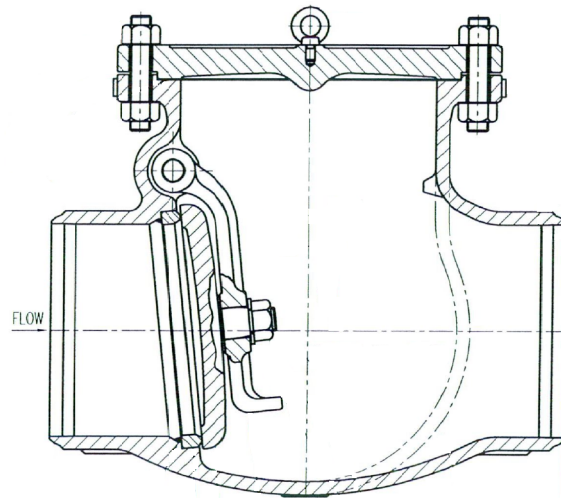
The purpose of the Equipment Survivability (ES) assessment is to show that there is reasonable assurance that the equipment and instrumentation used to mitigate and monitor severe accident progression will perform their intended functions (such as, hydrogen mitigation, containment monitoring, reactor cavity flooding, etc.) under the harsh environmental conditions of severe accidents. Check valve V1014 for ECSBS has a containment isolation function during normal operation and design basis accidents. In the severe accidents, the containment isolation function can be maintained by the ECSBS containment isolation valve (V1013) which is installed outside of containment, as shown in DCD Tier 2, Figure 6.2.2-1.

The check valve has another function of water delivery to the ECSBS header during severe accidents. However, the ES evaluation of the check valve is the same as piping due to its water delivery function to the ECSBS header, for the following reasons:

- The check valve resists damage due to temperature increases because the check valve consists of only metallic parts; the valve contains no organic materials. The metallic parts resist thermal damage which result from the hydrogen burn or the continuous temperature rise which results from decay heat.
- It is expected that the check valve continues to function due to its simple structure, as shown in Figure 1.

Therefore, it is not necessary to additionally evaluate the survivability of check valve V1014, and it is not required to be added to Table 19.2.3-4.

DCD Tier 2, Figure 19.1-3 will be revised to correct the directions of flow for check valves (V100, V101, V1007, V1008 and V1014), as shown in Attachment 2 to this response.



**Figure 1 Schematic Diagram for ECSBS Check Valve**

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#### **Impact on DCD**

DCD Tier 2, Figure 19.1-3 and Table 19.2.3-4 will be revised, as indicated in the attachments associated with this response.

#### **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**

Appendix F of the technical report for the severe accident analysis (Doc. No. APR1400-E-P-NR-14003) will be revised to reflect the contents of the response to this RAI.

**APR1400 DCD TIER 2**

Table 19.2.3-4

Systems and Equipment/Instrumentation Required  
for Equipment Survivability Assessments

**Security-Related Information – Withhold Under 10 CFR 2.390**

APR1400 DCD TIER 2

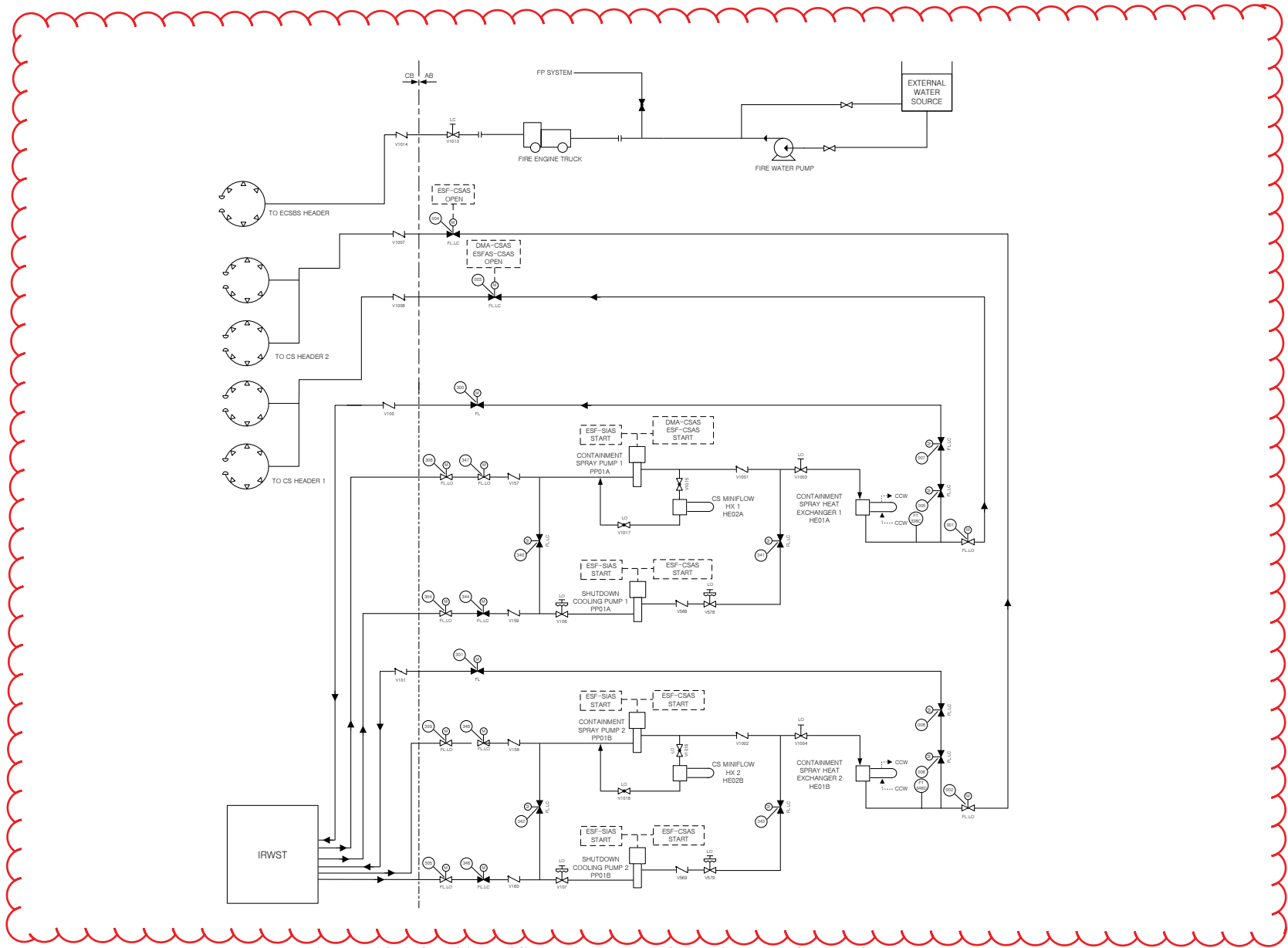


Figure 19.1-3 Simplified Diagram - Containment Spray System

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**Non-Security-Related Information**

