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## 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.: 407-8447  
SRP Section: 19.03 – Beyond Design Basis External Event  
Application Section: 19.03  
Date of RAI Issue: 02/17/2016

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### **Question No. 19.03-26**

Connections:

10 CFR 52.47(a)(2) requires that a standard design certification applicant provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished.

In SECY 12-0025, the staff provided the Commission with proposed orders requiring mitigation strategies for beyond-design-basis external events to be issued to all power reactor licensees and holders of construction permits. In the paper, the staff indicated that for New Reactors that are currently under active staff review, the staff plans to ensure that the Commission-approved Fukushima recommended actions are addressed prior to licensing. On March 12, 2012, the NRC issued Orders EA-12-049 requiring operating nuclear plants to develop and implement strategies that will allow them to cope without ac power for an indefinite amount of time. The strategies must ensure that the reactor core and spent fuel pool are adequately cooled, and containment function is maintained.

NEI 12-06, Section 3.2.2 states that the portable fluid connections for core and SFP cooling functions are expected to have a primary and an alternate connection. Both the primary and alternate connection points do not need to be available for all applicable hazards, but the location of the connection points should provide reasonable assurance of at least one connection being available.

The staff reviewed the information in APR1400-E-P-NR-14005-P, "Evaluations and Design Enhancements to Incorporate Lessons Learned from Fukushima Dai-Ichi Nuclear Accident," Section 5.1.2.4.1.2, comparing it with the NEI guidance. It is not clear whether the connections being used in the proposed mitigation strategies for SFP cooling are consistent with the

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guidance that the location of the connection points should provide reasonable assurance of at least one connection being available for all applicable external hazards.

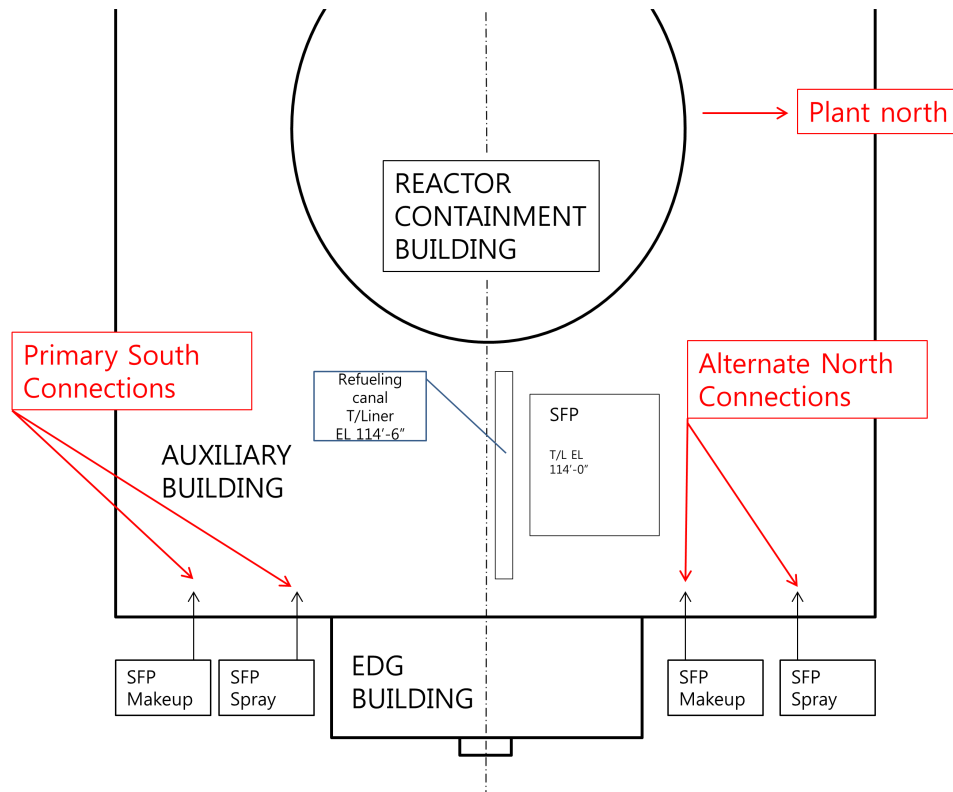
The applicant is requested to clarify how the APR1400 design for connections to the FLEX equipment is consistent with the NEI guidance.

**Response – (Rev. 1)**

The APR1400 mitigation strategy for SFP cooling is schematically illustrated in Figures 6-2 and 6-3, and the approximate locations for makeup water connections are indicated in Figure 6-4. The APR1400 design provides two locations for SFP makeup water connections: a set of two primary connections (one for makeup and one for spray) is mounted on the outside wall of the Auxiliary Building (AB), adjacent to the south side of the Emergency Diesel Generator (EDG) building; and the alternate set of identical connections (one for makeup and one for spray) is mounted on the outside wall of AB, adjacent to the north side of the EDG building. Please refer to Figure 1 below for illustration.

Since the external hazards (e.g., seismic events, floods, high winds, and associated missiles) are dependent on the site-specific characteristics, the protection design for applicable hazards should be the COL applicant's responsibility. Therefore, new COL item (COL19.3(16)) for the protection of the connections for FLEX strategies from external hazards will be added to DCD Tier 2 Subsection 19.3.2.3.4 and Technical Report APR1400-E-P-NR-14005-P/NP Section 6.2.11, respectively, as indicated in the attachment. In addition, a list of connections for the FLEX strategies (Table 6-5) will be added to Technical Report APR1400-E-P-NR-14005-P/NP as also indicated in the Attachment.

Furthermore, COL item 19.3(10) which discusses the electrical connection points will be revised to delete the description of electrical connection points for FLEX pumps since the FLEX pumps don't have electrical connection points as shown in the list of the connections for FLEX strategies (Table 6-5) in Technical Report APR1400-E-P-NR-14005-P/NP.



**Figure 1 Locations for SFP FLEX pump connection**

### Impact on DCD

DCD Tier 2 Table 1.8-2, Subsection 19.3.2.3.4, and Subsection 19.3.4 will be revised as indicated in 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

Technical Report APR1400-E-P-NR-14005-P/NP, Table 6-5 and Subsection 6.2.11 will be added as indicated in the Attachment.

## APR1400 DCD TIER 2

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Table 1.8-2 (29 of 29)

Item No.	Description
COL 19.3(1)	The COL applicant is to perform site-specific seismic hazard evaluation and seismic risk evaluation as applicable in accordance with NTTF Recommendation 2.1 as outlined in the NRC RFI.
COL 19.3(2)	The COL applicant is to address the flood requirements for wet sites
COL 19.3(3)	The COL applicant is to develop the details for offsite resources.
COL 19.3(4)	The COL applicant is to address the details of storage location for FLEX equipment.
COL 19.3(5)	The COL applicant is to address site-specific strategies to mitigate BDBEES as specified in the NRC Order EA-12-049.
COL 19.3(6)	The COL applicant is to address SFP level instrumentation maintenance procedure development and perform training as specified in NRC Order EA-12
COL 19.3(7)	The COL applicant is to address development of EOPs, SAMGs, and EDMGs that incorporate lessons learned from TEPCO's Fukushima Dai-Ichi nuclear power plant accident as addressed in SECY-12-0025.
COL 19.3(8)	The COL applicant is to address enhancement of the offsite communication system as specified in the NRC Request for Information pertaining to NTTF Recommendation 9.3.
COL 19.3(9)	The COL applicant is to address staffing for large-scale natural events as specified in the NRC RFI pertaining to NTTF Recommendation 9.3. <span style="border: 1px solid black; padding: 2px;">accessibility,</span>
COL 19.3(10)	The COL applicant is to provide site-specific details of the electrical connection points (including locations, voltage level, and electrical classification) for <del>FLEX equipment such as FLEX pumps and mobile GTGs.</del> <span style="border: 1px solid black; padding: 2px;">the</span>
COL 19.3(16)	The COL applicant is to ensure that all the connections (refer to Table 6-5 in Reference 5) for FLEX strategies located outside the buildings are accessible and protected from all applicable external hazards (e.g., seismic events, floods, high winds, and associated missiles).

Add

event. The technical report (Reference 5) provides the containment pressure and temperature analyses response for the full-power case with the assumed RCP seal leakage, and confirms that, during the course of the event for all phases, containment integrity is maintained.

Loss of RHR during mid-loop operation in Mode 5 is additionally assumed for the evaluation of containment capability. In this event, steam is assumed to be released from the RCS to the containment through the pressurizer manway due to the boiling of reactor coolant following the loss of RHR. The ECSBS is assumed to start spraying water into the containment atmosphere via a FLEX pump when the containment pressure reaches the UPC value of 12.9 kg/cm<sup>2</sup> (184 psia). After the initial operation, the ECSBS is assumed to be intermittently operated for 2 hours whenever the containment pressure reaches the UPC value. GOTHIC analyses are performed to confirm that the containment pressure and the temperature can be controlled within the UPC limit with the ECSBS operation following the loss of RHR in mode 5.

#### 19.3.2.3.4 Supporting Systems

To mitigate the BDBEE, the following supporting systems have also been evaluated in Reference 5:

- a. Electrical system (ac power and dc power)
- b. Emergency lighting
- c. Communication system
- d. Water sources
- e. Fuel oil

The design approach meets the NEI 12-06 in meeting the N+1 approach for the FLEX equipment, and primary and alternative connection points for fluids and electrical items.

Regarding the storage of robust FLEX equipment and commodities, the N+1 philosophy has been adopted for the storage housing. Reference 5 describes the requirements in detail and the necessary design changes for APR1400 to meet the industry regulations. The

~~The COL applicant is to provide site-specific details of the electrical connection points (including locations, voltage level, and electrical classification) for FLEX equipment such as FLEX pumps and mobile GTGs (COL 19.3(10)).~~

Add

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COL applicant is to address details of the storage location for FLEX equipment (COL 19.3(4)).

Also, the COL applicant is to address site-specific strategies to mitigate BDBEEs as specified in NRC Order EA-12-049 (COL 19.3(5)), including but not limited to the following:

- a. Evaluation of site-specific external hazards
- b. Determination and protection of portable equipment
- c. Providing means for acquisition, staging, and installation of equipment
- d. Establishing means for maintaining and testing of portable equipment
- e. Establishing procedures and guidance on mitigation of BDBEEs
- f. Establishing training of personnel to the developed strategies and procedures

#### 19.3.2.4 Recommendation 7.1 – Reliable Spent Fuel Pool Instrumentation

The APR1400 employs reliable indication of the water level in the SFP capable of supporting identification of the following pool water level conditions:

- a. Level that is adequate to support operation of the normal fuel pool cooling system
- b. Level that is adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck
- c. Level at which fuel remains covered and actions to implement makeup water addition should no longer be deferred

The APR1400 SFP water level instrumentation is consistent with the guidelines addressed in NRC EA-12-051, NEI 12-02 (Reference 8), and JLD-ISG-2012-03 (Reference 9).

The primary instrument channel provides level indication through the use of guided wave radar (GWR) technology using the principle of time domain reflectometry (TDR).

The COL applicant is to provide site-specific details of the electrical connection points (including locations, accessibility, voltage level, and electrical classification) for the mobile GTGs (COL 19.3 (10)).

The COL applicant is to ensure that all the connections (refer to Table 6-5 in Reference 5) for FLEX strategies located outside the buildings are accessible and protected from all applicable external hazards (e.g., seismic events, floods, high winds, and associated missiles) (COL 19.3 (16)).

## APR1400 DCD TIER 2

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- COL 19.3(3) The COL applicant is to develop the details for offsite resources.
- COL 19.3(4) The COL applicant is to address the details of storage location for FLEX equipment.
- COL 19.3(5) The COL applicant is to address site-specific strategies to mitigate BDBEEs as specified in the NRC Order EA-12-049.
- COL 19.3(6) The COL applicant is to address SFP level instrumentation maintenance procedure development and perform training as specified in NRC Order EA-12-051.
- COL 19.3(7) The COL applicant is to address development of EOPs, SAMGs, and EDMGs that incorporate lessons learned from TEPCO's Fukushima Dai-ichi nuclear power plant accident as addressed in SECY-12-0025.
- COL 19.3(8) The COL applicant is to address enhancement of the offsite communication system as specified in the NRC Request for Information pertaining to NTTF Recommendation 9.3.
- COL 19.3(9) The COL applicant is to address staffing for large-scale natural events as specified in the NRC RFI pertaining to NTTF Recommendation 9.3.

Add

19.3.5 References

1. SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," U.S. Nuclear Regulatory Commission, February 2012.
2. Order EA-12-049, "Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," U.S. Nuclear Regulatory Commission, March 12, 2012.
3. Order EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," U.S. Nuclear Regulatory Commission, March 12, 2012.

COL 19.3(16) The COL applicant is to ensure that all the connections (refer to Table 6-5 in Reference 5) for FLEX strategies located outside the buildings are accessible and protected from all applicable external hazards (e.g., seismic events, floods, high winds, and associated missiles).

accessibility,

COL 19.3(10) The COL applicant is to provide site-specific details of the electrical connection points (including locations, voltage level, and electrical classification) for ~~FLEX equipment such as FLEX pumps and mobile GTGs.~~

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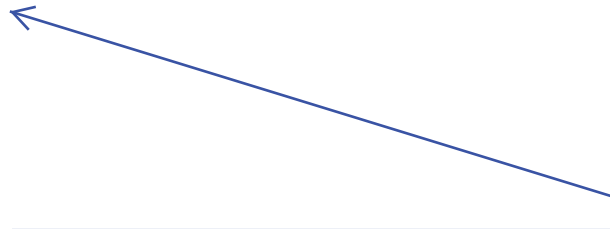
**6.2.8 Emergency Procedures**

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The emergency communication system/enhancement, staffing large-scale natural events, and revisions to EP for ELAP are COL items.

**6.2.9 Storage of FLEX Equipment**

In accordance with NEI 12-06 (Reference 8), the FLEX equipment is stored in dedicated building/structure that will withstand the BDBEEs and meet the requirements of 10 CFR 50, Appendix A, GDC 2. The N+1 equipment is stored in separate buildings.

**6.2.11 Connections for FLEX strategies**

The detailed design of connections for FLEX strategies located outside the buildings is the responsibility of COL applicant. The COL applicant is to ensure that all the connections (See Table 6-5) for FLEX strategies located outside the buildings are accessible and protected from all applicable external hazards (e.g., seismic events, floods, high winds, and associated missiles).

Table 6-1 (1 of 2)

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External Connection Components for BDBEE

Component	DCD Chapter and/or Section	Function
V2601	Figure 6.3.1-2	SFP external makeup line check valve
V2602	Figure 6.3.1-2	SFP external makeup line isolation valve
V2605	Figure 6.3.1-2	SFP external spray line check valve
V2606	Figure 6.3.1-2	SFP external spray line isolation valve
V2611	Figure 6.3.1-2	SFP external makeup line check valve
V2612	Figure 6.3.1-2	SFP external makeup line isolation valve
V2615	Figure 6.3.1-2	SFP external spray line check valve
V2616	Figure 6.3.1-2	SFP external spray line isolation valve
SI-801	Table 3.9-4, Table 3.9-13, Figure 6.3.2-1 (4 of 4)	External emergency injection line check valve
SI-803	Table 3.9-4, Table 3.9-13, Figure 6.3.2-1 (4 of 4)	External emergency injection line isolation valve
SI-805	Figure 6.3.2-1 (4 of 4)	External emergency injection line fill isolation valve
SI-807	Figure 6.3.2-1 (4 of 4)	External emergency injection line isolation valve
CH-784	Figure 9.3.4-1 (4 of 7)	Primary side high-head FLEX pump suction isolation
V2678A	Figure 10.4.9-1	AF FLEX pump suction line backflow prevention
V2678B	Figure 10.4.9-1	AF FLEX pump suction line backflow prevention
V2679A	Figure 10.4.9-1	AF FLEX pump suction line isolation
V2679B	Figure 10.4.9-1	AF FLEX pump suction line isolation
V2098A	Figure 10.4.9-1	AF FLEX pump discharge line backflow prevention
V2098B	Figure 10.4.9-1	AF FLEX pump discharge line backflow prevention
V2102A	Figure 10.4.9-1	AF FLEX pump discharge line isolation
V2102B	Figure 10.4.9-1	AF FLEX pump discharge line isolation
V2001A	Figure 9.5.4-1	Diesel fuel oil day tank discharge line to mobile equipment isolation
V2001B	Figure 9.5.4-1	Diesel fuel oil day tank discharge line to mobile equipment header isolation
V2001C	Figure 9.5.4-1	Diesel fuel oil day tank discharge line to mobile equipment header isolation
V2001D	Figure 9.5.4-1	Diesel fuel oil day tank discharge line to mobile equipment header isolation
V2202A	Figure 9.5.4-1	Diesel fuel oil supply line to mobile GTG isolation
V2202B	Figure 9.5.4-1	Diesel fuel oil supply line to mobile GTG isolation
V2202C	Figure 9.5.4-1	Diesel fuel oil supply line to mobile GTG isolation
V2202D	Figure 9.5.4-1	Diesel fuel oil supply line to mobile GTG isolation

← Insert Table 6-5 (new table)

Table 6-5

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List of Connections for FLEX strategies

<b>FLEX Equipment</b>	<b>Connections</b>	<b>Quantity</b>	<b>Location</b>	<b>Functional Requirement</b>
Primary side high-head or primary side low-head FLEX pump	Discharge connection	1	Outside Building	To supply makeup water to RCS
SFP makeup FLEX pump	Discharge connections	2	Outside Building	To supply makeup water to SFP
SFP spray FLEX pump	Discharge connections	2	Outside Building	To supply makeup water to SFP
ECSBS FLEX pump	Discharge connection	1	Outside Building	To prevent containment over-pressurization
Secondary side FLEX pump	Discharge connections	2	Outside Building	To supply cooling water to associated SG
Secondary side FLEX pump	Suction connections	2	Outside Building	To supply cooling water to associated SG
Primary side high-head FLEX pump	Suction connection	1	Outside Building	To supply makeup water to RCS
FLEX pumps and mobile GTGs	Fuel oil supplying connections	14	Outside Building	To supply fuel oil to FLEX pumps and mobile GTG
The 480V mobile GTG	Electrical connections	2	COL 19.3(10)	To supply the power to Class 1E 480V load centers
The 4.16 kV mobile GTG	Electrical connections	2	COL 19.3(10)	To supply the power to 4.16 kV switchgear