
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.: 176-8089
SRP Section: 03.11 - Environmental Qualification of Mechanical and Electrical Equipment
Application Section: 3.11
Date of RAI Issue : 08/31/2015

Question No. 03.11-10

10 CFR 50.49 and 10 CFR 50, Appendix A, criterion 4 require that certain components important to safety be designed to withstand environmental conditions, including the effects of radiation, associated with design basis events, including normal operation, anticipated operational occurrences, and design basis accidents.

SRP Section 3.11 indicates that the applicant's safety analysis report should be sufficient to support the conclusion that all items of equipment that are important to safety are capable of performing their design safety functions under all environmental conditions that may result from any normal mode of plant operation, anticipated operational occurrence, design basis events, post-design basis events, and containment tests.

In addition, SRP 3.11 also states that, "the equipment shall be designed to have the capability of performing its design safety functions under all anticipated operational occurrences and normal, accident, and post-accident environment, and for the length of time for which its function is required."

If consideration is not properly given to the combined effects of normal operation and accident conditions, equipment could unnecessarily exceed its design limitations during a design basis accident which could result in significant complications or significant personnel exposure. For example, if a piece of equipment is designed to a designed dose of 10,000 Rad and it is expected to receive 7,000 Rad during the worst case design basis accident for which that piece of equipment is required to operate, then the dose to that piece of equipment should be limited to 3,000 Rad during normal operation prior to replacement, unless the piece of equipment is intended to be replaced during an accident. Please indicate if it is anticipated that any equipment under the equipment qualification program will exceed its designed pressure, temperature, relative humidity, radiation dose, or chemical limitations (or combination thereof) or need to be replaced, due to potentially exceeding its design limits, during the period which it is needed to remain functional during a design basis accident.

If no, then please clearly include a statement in the FSAR indicating that replacement of equipment will be made before the maximum calculated DBA conditions that could result in exceeding design limits for a piece of equipment, when considering the cumulative effects of the normal operating conditions that each piece of equipment has received, as well as the maximum cumulative worst case conditions calculated for the worst case accident.

If yes (design limits could be exceeded and/or may need to be replaced during an accident due to potentially exceeding limits for certain components), please discuss, in the FSAR, how environmental conditions will permit workers to access these areas in order to replace equipment during accident conditions and evaluate the radiation dose that a worker would receive in order to make the replacement.

Response

It is not anticipated that any equipment under the equipment qualification program will exceed its designed pressure, temperature, relative humidity, radiation dose, or chemical limitations (or combination thereof) or need to be replaced, due to potentially exceeding its qualified design limits, during the normal and accident period in which it is needed to remain functional.

The goal of the qualification is to demonstrate that safety related equipment is capable of performing its safety function within the defined design limits without any common cause failures when exposed to the DBA conditions associated with its required service environments. If such equipment exceeds its design limits (as specified in the qualification program), KHNP considers it as not meeting the qualification requirements.

Procurement specifications will require equipment suppliers to design their equipment in accordance with the design criteria specified and furthermore, to ensure that safety related equipment shall remain qualified for the specified period including DBA conditions. For the cases when equipment with a shorter qualified life than the design life of the plant is used, KHNP expects the operating plant licensee to ensure that these components would be incorporated into the plant's operating programs through periodic surveillances and planned maintenance/replacement schedules based upon the established qualified life of the components.

For such equipment, KHNP will state in the content related to the replacement of equipment in DCD section 3.11 the following:

“Replacement of equipment will be made before the maximum calculated DBA conditions that could result in exceeding design limits for a piece of equipment, when considering the cumulative effects of the normal operating conditions that each piece of equipment has received, as well as the maximum cumulative worst case conditions calculated for the worst case accident.”

Impact on DCD

DCD section 3.11.2.2 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

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

APR1400 DCD TIER 2

The safety-related active mechanical equipment that may contain non-metallic parts are qualified in accordance with ASME Standard QME-1-2007, as endorsed by RG 1.100, Revision 3, and is listed in Table 3.11-3 as specified by RG 1.206, Section C.I.3.11.6.

The safety-related mechanical equipment that may contain nonmetallic parts is specified in Table 3.11-3 in accordance with ASME Standard QME-1-2007, as endorsed by RG 1.100, Revision 3. The nonmetallic subcomponent (e.g., seals, gaskets, lubricants) materials are identified in the procurement process, and are expected to change by vendors.

3.11.2.1 Environmental Qualification during Normal Operation

Equipment which is not significantly affected environmentally by the design basis accident (DBA) is said to exist in a mild (normal plus abnormal service conditions) environment. For the qualification of both electrical and mechanical equipment in a mild environment, a qualified life is not required if no significant aging mechanism in mild conditions is identified in accordance with IEEE Std. 323. If the predicted life based on experience, aging analysis, or tests is less than the design life of the plant, that equipment is subjected to a surveillance program and a preventative maintenance program that restores it to qualified operability. The detailed maintenance or surveillance program for specific plants is to be developed based on the specific equipment for the APR1400 and the results of qualification testing and analysis for that equipment.

The ranges of the design temperatures, pressures, relative humidity, and radiation for typical mild environment areas in which safety-related equipment is located are provided in Table 3.11-2.

3.11.2.2 Environmental Qualification during and after a Design Basis Accident

Equipment located in harsh environments is designed to remain functional in the environment that exists at the equipment location, for the length of time during and after the DBA for which it is required to be functional, and for the integrated radiation dose during normal operation. The temperature, pressure, and humidity environment inside the containment after a LOCA and MSLB is discussed in detail in Subsections 6.2.1.3 and 6.2.1.4. The containment spray characteristics are given in Subsection 6.2.2.1. The worst-case integrated post-accident radiation doses for those areas at which equipment is located are provided in Table 3.11-2.

Replacement of equipment will be made before the maximum calculated DBA conditions that could result in exceeding design limits for a piece of equipment, when considering the cumulative effects of the normal operating conditions that each piece of equipment has received, as well as the maximum cumulative worst case conditions calculated for the worst case accident.