

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.: 516-8646
SRP Section: 19.03 – Beyond Design Basis External Event (APR1400)
Application Section: 19.3
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Question No. 19.03-40

The NRC staff provided guidance for satisfying the Commission directives regarding Beyond Design Basis External Events (BDBEE) mitigation strategies in Japan Lesson-Learned Project Directorate (JLD)-ISG-2012-01, Revision 0, "Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events." JLD-ISG-2012-01 endorsed with clarification the methodologies described in the industry guidance document Nuclear Energy Institute (NEI) 12-06, Revision 0, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide." The guidance in JLDISG-2012-01 describes one acceptable approach for satisfying the Commission directives regarding BDBEE mitigation strategies.

According to DCD Section 19.3.2.3, "Recommendations 4.1 and 4.2 – Station Blackout and Mitigation Strategies for Beyond Design Basis External Events", NEI 12-06 was considered in developing the APR1400 FLEX strategy. NEI 12-06 states that the effects of loss of heating, ventilation, and air conditioning (HVAC) in an extended loss of ac power event can be addressed consistent with NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors."

The response to RAI 406-8427, dated March 15, 2016 (ADAMS accession no. ML16075A418), states that the acceptance criteria for the APR1400 are set with reference to NUMARC 87-00, Rev 1. It also states that the maximum allowable temperature for the main control room (MCR) and technical support center (TSC), 110 °F, follows the habitability requirement specified in NUMARC 87-00. NUMARC 87-00 Rev. 1, refers to habitability conditions in ASHRAE Handbook (1985) which correlates temperature, humidity, and pressure and concludes that light work above 110 °F and relative humidity above 50% would be intolerable.

The present APR1400 calculation, "Room Heatup Calculation for Main Control Room, 1-601-M370-001, Rev. 1", reviewed in response to RAI 406-8427, shows that the maximum temperature of the MCR and TSC is below 110 °F however the RAI response and calculation do not demonstrate consideration of relative humidity. Therefore, as a follow-up RAI, the applicant

is requested to justify how the relative humidity component of ASHRAE 1985 is satisfied in concert with the temperature requirement.

Response

NEI 12-06, Revision 0, Section 3.2.1.8 "Effects of Loss of Ventilation," states that the effects of loss of HVAC in an extended loss of ac power event can be addressed consistent with NUMARC 87-00. Therefore, the acceptance criteria for the APR1400 are set with reference to NUMARC 87-00, Revision 1. NUMARC 87-00 Rev. 1, refers to habitability conditions in ASHRAE Handbook (1985) which correlates temperature, humidity, and pressure and concludes that light work above 110 °F and relative humidity above 50% would be intolerable.

Before Beyond Design Basis External Events (BDBEE), it is assumed that the main control room (MCR) is at 77°F and 50% relative humidity, and technical support center (TSC) is at 80°F and 50% relative humidity. Although the temperature increases due to loss of HVAC, the relative humidity decreases.

The humidity ratio in the MCR is 69.5 grain/lb at the initial condition, 77°F and 50% relative humidity. The humidity ratio in the TSC is 76.8 grain/lb at the initial condition, 80°F and 50% relative humidity. The maximum temperatures during 72 hours under loss of HVAC system are 109.8°F for MCR and 107.6°F for TSC.

Since HVAC equipment is assumed to be failed, there will be no airflow from and out of MCR and TSC, thus there will be few factors in increasing absolute humidity, or humidity ratio. In the case of MCR, the relative humidity both at the humidity ratio of the initial condition (69.5 grain/lb) and at the maximum temperature (109.8°F) is 18.1%. In the case of TSC, the relative humidity both at the humidity ratio of the initial condition (76.8 grain/lb) and at the maximum temperature (107.6°F) is 21.3%.

Thus it meets what NUMARC 87-00 requires as criteria of relative humidity, below 50%.

		MCR	TSC
Initial Condition	Temperature	77°F	80°F
	Relative Humidity	50%	50%
	Humidity Ratio	69.5 grain/lb	76.8 grain/lb
maximum temperatures during 72 hours		109.8°F	107.6°F
Relative Humidity at humidity ratio of initial condition and maximum temperature		18.1%	21.3%

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 Report.