

KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Thursday, August 13, 2015 10:52 AM
To: KHNPDCDRAIsPEm Resource
Subject: FW: APR1400 Design Certification Application RAI 126-8012 (Regional Climatology)
Attachments: APR1400 DC RAI 126 RHMB 8012.pdf

From: Ward, William
Sent: Tuesday, August 04, 2015 6:39 PM
To: 'apr1400rai@khnp.co.kr' <apr1400rai@khnp.co.kr>; KHNPDCDRAIsPEm Resource <KHNPDCDRAIsPEm.Resource@nrc.gov>; 'Chang, Harry' <hyunseung.chang@gmail.com>; 'Yunho Kim (yshh8226@gmail.com)' <yshh8226@gmail.com>; jiyong.oh5@gmail.com; daegeun.ahn@gmail.com; Mannon, Steven (steven.mannon@aecom.com) <steven.mannon@aecom.com>
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Subject: APR1400 Design Certification Application RAI 126-8012 (Regional Climatology)

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, the time shown below to respond to the RAI questions. We may adjust the schedule accordingly.

<u>Question</u>	<u>Time to respond</u>
02.03.01-1	30 days
02.03.01-2	30 days
02.03.01-3	90 days
02.03.01-4	30 days

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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Hearing Identifier: KHNP_APR1400_DCD_RAI_Public
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From: Ciocco, Jeff

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U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

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Issue Date: 08/04/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 02.03.01 - Regional Climatology
Application Section: Regional Climatology

QUESTIONS

02.03.01-1

APR1400 DCD, Tier 2 Table 2.0-1, "Site Parameters," and Tier 1 Table 2.1-1, "Site Parameters," includes numerous site parameter values that do not use consistent precision regarding the number of decimal places. For example, in APR1400, Tier 2, Table 2.0-1:

Ambient Design Temperature for Cooling Tower	
- Ambient 5 % annual exceedance values for circulating water system (CWS)	
· Maximum 26.1 °C (79 °F) non-coincident wet bulb	26.1 °C (79 °F) non-coincident wet bulb
· Minimum	-20.6 °C (-5 °F)

In the table above the parameter values presented in Celsius (°C) are presented with one decimal place (e.g., 26.1 °C) whereas the values presented in Fahrenheit (°F) are presented with no decimal place (e.g., 79 °F).

Please update DCD Tier 2 Table 2.0-1 and Tier 1 Table 2.1-1 to ensure consistent precision of site parameter values and to avoid potential confusion for any future ESP or COL applicants.

02.03.01-2

APR1400 DCD, Tier 2 Table 2.0-1, "Site Parameters," and Tier 1 Table 2.1-1, "Site Parameters," each contain a site parameter value for the "Maximum 1% exceedance dry-bulb temperature) of 43.3 °C (100 °F). The staff believes either the Celsius temperature or the Fahrenheit temperature to be in error as 43.3 °C is equal to 110 °F.

Update APR1400 DCD, Tier 2 Table 2.0-1 and Tier 1 Table 2.1-1 to correct this error.

02.03.01-3

The Staff considered the December 23, 2014 re-submittal, by Korea Hydro and Nuclear Power Co., Ltd. (KHNP), of Revision 0 of its application for Design Certification of the APR1400 Standard Design (ML15006A059) - in particular, Design Control Document (DCD) Tier 1, Table 2.1-1, DCD Tier 2, Table 2.0-1, DCD Tier 2 Section 2.3.1, and related information - along with KHNP's proposed responses, dated May 12, 2015, to requests for clarifications related to hydrology and meteorology (see ML15132A599 and ML15132A600).

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DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 list design ambient temperature site parameter values applicable to the circulating water system (CWS) and essential service water system (ESWS) design, designated as:

- 5% Annual Exceedance Values for the CWS (i.e., maximum non-coincident wet-bulb, and presumably minimum dry-bulb temperatures); and
- 0% Annual Exceedance Values for the ESWS (i.e., maximum non-coincident wet-bulb, and presumably minimum dry-bulb temperatures).

DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 also list design ambient temperature site parameter values applicable to Heating, Ventilation, and Air Conditioning (HVAC) design, designated as:

- 5% and 1% Annual Exceedance Values (i.e., maximum dry-bulb and coincident wet-bulb, and presumably minimum dry-bulb temperatures); and
- 0% Annual Exceedance Values (i.e., maximum dry-bulb and coincident wet-bulb, and presumably minimum dry-bulb temperatures) as historical limits excluding peaks less than 2 hours duration.

Pursuant to 10 CFR 52.47(a)(1), a Design Certification (DC) applicant is required to provide site parameters postulated for its design and an evaluation of its design in terms of those site parameters. In turn, NUREG-0800, SRP Section 2.3.1, Subsection IV (Evaluation Findings), Item 4(b), in part, calls for the NRC staff to reach a conclusion that “[t]he postulated site parameters are representative of a reasonable number of sites that have been or may be considered for a COL application”. In order to reach such a conclusion with respect to the design-basis dry- and/or wet-bulb ambient temperature site parameters, the Applicant should address the following technical issues:

- a) The 0% annual exceedance non-coincident wet-bulb temperature is listed in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 as 27.2 °C (81 °F). Subsection 9.2.5.2.2.1 of the DCD Tier 2 FSAR identifies the Ultimate Heat Sink (UHS) cooling towers as mechanical draft type and designed to this site parameter value under accident conditions. The staff notes that although not cited in DCD Tier 1, Table 2.1-1 or DCD Tier 2, Table 2.0-1, the design ambient temperature site parameters and values for all percent exceedance levels are the same as those specified in earlier revisions of the Electric Power Research Institute (EPRI) Utility Requirements Document (URD) for Advanced Light Water Reactors.

The staff also notes that many of the previously reviewed DC applications for other new reactor designs initially referenced the EPRI URD for the same design ambient temperature site parameters, and in many cases subsequently revised several of these site parameter values, including the 0% exceedance non-coincident wet-bulb temperature. The staff further notes that almost all of the Combined License (COL) and Early Site Permit (ESP) applications that it has reviewed identify 0% exceedance non-coincident wet-bulb temperatures greater than the corresponding site parameter value listed in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 of the APR1400 DC application. The table below summarizes many of these values:

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Site	0% Exceedance NCWB (°F)
KNHP-APR1400	81
Bellefont	83.5
Callaway	81
Comanche Peak	86
Fermi	86.0
Grand Gulf	81
Levy County	85.5
Nine Mile Point	82.3
North Anna	88
River Bend	85.2
Shearon Harris	83.5
South Texas	88.3
Turkey Point	87.4
Victoria ESP	86.1
V.C. Summer	87.3
Vogle	83.9
William States Lee	85
PSEG ESP	86.2

Note: NCWB = Non-Coincident Wet-Bulb Temperature

The geographical area covered by these site locations (under development and potential) is diverse not only in latitude and longitude, but in topographic setting (i.e., coastal and interior) as well.

Given the preceding, either update the DC application where applicable by justifying the selection of the 0% annual exceedance non-coincident wet-bulb temperature as listed in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 (i.e., 27.2 °C (81 °F)) such that the staff can reach its conclusion as stated in the SRP 2.3.1 guidance, or revise the indicated site parameter value and any other related site parameter value(s), text, and associated current or new table(s).

- b) Evaluate whether any other design ambient temperature site parameters and values listed in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1, should be similarly revised based on the lessons learned from previous DC, COL, and ESP application submittals to the staff for review. If so, revise the affected site parameter value(s), text, and associated current or new table(s).
- c) NUREG-0800, SRP Section 2.3.1, Subsection I (Areas of Review), Item 6, states, with respect to meteorological conditions identified as - (1) site characteristics for ESP

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applications, (2) design and operating bases for Construction Permit, Operating License, and COL applications, and (3) site parameters for DC applications – including, among others “ambient temperature and humidity statistics...for use in establishing heat loads for the design of normal plant heat sink systems, post-accident containment heat removal systems, and plant heating, ventilating, and air conditioning systems” that “[a]ll references to FSAR sections in which these conditions are used should be identified by the applicant”.

As indicated previously, DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 list design ambient temperature site parameter values applicable to the following systems:

- 5% Annual Exceedance Values for the CWS (i.e., maximum non-coincident wet-bulb, and presumably minimum dry-bulb temperatures);
- 0% Annual Exceedance Values for the ESWS (i.e., maximum non-coincident wet-bulb, and presumably minimum dry-bulb temperatures);
- 5% and 1% Annual Exceedance Values for HVAC systems (i.e., maximum dry-bulb and coincident wet-bulb, and presumably minimum dry-bulb temperatures); and
- 0% Annual Exceedance Values for HVAC systems (i.e., maximum dry-bulb and coincident wet-bulb, and presumably minimum dry-bulb temperatures) as historical limits excluding peaks less than 2 hours duration.

Subsection 9.2.5.2.2.1 of the DCD Tier 2 FSAR and related Table 9.2.5-3 identify the percent annual exceedance levels that apply to the UHS cooling towers under normal operating and accident conditions. In contrast, the introduction to DCD Tier 2 FSAR Section 9.4 merely states that “[t]he HVAC outdoor air design temperature conditions are shown in Table 2.0-1” while there are three distinct annual percent exceedance levels associated with various (presumably safety- and non-safety-related) HVAC systems.

In order for subsequent ESP and COL applicants to properly associate site characteristic values with the corresponding design ambient temperature site parameter values listed in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1, and consistent with the guidance in SRP Section 2.3.1 for applicants to identify the “FSAR sections in which these conditions are used” (i.e., linked to specific structures, systems, and components (SSCs)), the applicant should either confirm where the DCD FSAR already clearly identifies these associations or:

- revise the appropriate sections of the DCD FSAR and current or new tables and/or figures, as appropriate, where such conditions are applicable to the design or operation of an SSC;
- delete design ambient temperature site parameters and values where no such association exists with the design or operation of an SSC; and
- confirm that associations are clearly identified in the DCD FSAR for the other climate-related site parameters and values listed in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 (i.e., precipitation and structural loads, extreme wind,

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tornado and hurricane parameters) or revise the related sections of the DCD FSAR and current or new tables and/or figures, as appropriate.

- d) Confirm whether the minimum temperature values listed among the design ambient temperature site parameters in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 represent dry-bulb temperature values (as appears to be the case). If so, clarify the respective table entries by annotating accordingly.
- e) Confirm whether the 0% Annual Exceedance Values for the ESWS (i.e., maximum non-coincident wet-bulb, and presumably minimum dry-bulb temperatures) listed in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 represent an historical limit or limits excluding peaks less than two hours as shown for the 0% Annual Exceedance Values for HVAC systems (i.e., maximum dry-bulb and coincident wet-bulb, and presumably minimum dry-bulb temperatures). The staff notes that the minimum (presumably dry-bulb) temperature values are the same in both cases (i.e., -40.0 °C (-40 °F)).

In order for subsequent ESP and COL applicants to properly develop site characteristic values for comparison to corresponding design ambient temperature site parameter values and, therefore, facilitate the staff's eventual review, the applicant should either:

- annotate the 0% Annual Exceedance Values for the ESWS accordingly, if one or both of those values represent an historical limit or limits excluding peaks less than two hours, or
- if not the case, add footnotes to DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 to indicate how the respective 0% Annual Exceedance site parameter values were determined because they represent two different statistics.

02.03.01-4

APR1400 DCD, Tier 2, Table 2.0-1, "Site Parameters," and Tier 1, Table 2.1-1, "Site Parameters," each contain a site parameter value within the "Precipitation" parameter description row called "Extreme winter precipitation roof load." This value is indicated in both Tier 1 and Tier 2 tables as 5.985 kPa (125 lbf/ft²).

In order for subsequent ESP and COL applicants to properly associate site characteristic values with the corresponding design parameter values listed in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1, and consistent with the guidance in SRP Section 2.3.1 for applicants to identify the "FSAR sections in which these conditions are used" (i.e., linked to specific structures, systems, and components (SSCs)), the applicant should clarify where the DCD FSAR already clearly identifies these associations or update the SSAR to indicate where in the APR1400 DCD FSAR this site parameter value is connected to specific SSCs or roof loads.