KHNPDCDRAIsPEm Resource

From:	Ciocco, Jeff
Sent:	Monday, November 16, 2015 1:13 PM
To:	apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; Harry (Hyun Seung) Chang; Andy Jiyong Oh; Steven Mannon
Cc:	Tsirigotis, Alexander; Clark, Theresa; Umana, Jessica; Ng, Ronnie; Lee, Samuel
Subject:	APR1400 Design Certification Application RAI 311-8278 (03.12 - ASME Code Class 1, 2, and 3 Piping Systems and Piping Components and Their Associated Supports)
Attachments:	APR1400 DC RAI 311 RPAC 8278.pdf

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, 45 days to respond to this RAI. We may adjust the schedule accordingly.

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

Thank you,

Jeff Ciocco
New Nuclear Reactor Licensing
301.415.6391
jeff.ciocco@nrc.gov

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Hearing Identifier: KHNP_APR1400_DCD_RAI_Public
Email Number: 360

Mail Envelope Properties (410df1972d3749e79a249fd6dc660ebb)

Subject: APR1400 Design Certification Application RAI 311-8278 (03.12 - ASME Code Class 1, 2, and 3 Piping Systems and Piping Components and Their Associated Supports)
Sent Date: 11/16/2015 1:13:14 PM
Received Date: 11/16/2015 1:13:15 PM
From: Ciocco, Jeff

Created By: Jeff.Ciocco@nrc.gov

Recipients:
"Tsirigotis, Alexander" <Alexander.Tsirigotis@nrc.gov>
Tracking Status: None
"Clark, Theresa" <Theresa.Clark@nrc.gov>
Tracking Status: None
"Umana, Jessica" <Jessica.Umana@nrc.gov>
Tracking Status: None
"Ng, Ronnie" <Ronnie.Ng@nrc.gov>
Tracking Status: None
"Lee, Samuel" <Samuel.Lee@nrc.gov>
Tracking Status: None
"apr1400rai@khnp.co.kr" <apr1400rai@khnp.co.kr>
Tracking Status: None
"KHNPDCDRAIsPEm Resource" <KHNPDCDRAIsPEm.Resource@nrc.gov>
Tracking Status: None
"Harry (Hyun Seung) Chang" <hyunseung.chang@gmail.com>
Tracking Status: None
"Andy Jiyong Oh" <jiyong.oh5@gmail.com>
Tracking Status: None
"Steven Mannon" <steven.mannon@aecom.com>
Tracking Status: None

Post Office: HQPWMSMRS07.nrc.gov

Files	**Size**	**Date & Time**
MESSAGE	608	11/16/2015 1:13:15 PM
APR1400 DC RAI 311 RPAC 8278.pdf	118185	
image001.jpg	5040	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

REQUEST FOR ADDITIONAL INFORMATION 311-8278

Issue Date: 11/16/2015
Application Title: APR1400 Design Certification Review – 52-046
Operating Company: Korea Hydro & Nuclear Power Co. Ltd.
Docket No. 52-046
Review Section: 03.12 - ASME Code Class 1, 2, and 3 Piping Systems and Piping Components and Their Associated Supports
Application Section:

QUESTIONS

03.12-4

ASME Boiler and Pressure Vessel Code (BPV Code) Section III, as mandated by 10 CFR 50.55a, requires that the effects of seismic and thermal movements of pipe restraints such as equipment nozzles, pipe supports, pipe anchors, and pipe headers (in the case of decoupled pipe branches) are considered in the piping analysis. DCD Section 3.12.5.3.3 states the following: "Thermal anchor movements less than or equal to 1.6 mm (1/16 in) may be excluded from analysis since this represents the industry practice when acceptable gaps in pipe supports allow (Reference 29)." The applicant is requested to provide additional information on its approach to demonstrate that when the piping analysis has excluded pipe restraint movement(s), adequate gap(s) exist in the as-built pipe supports to accommodate the excluded from the analysis pipe restraint movement(s).

03.12-5

ASME BPV Code Section III, as mandated by 10 CFR 50.55a, requires that the effects of deadweight be accounted for in the piping analysis. DCD Section 3.12.6.11 states that "[t]he normal design practice for the APR1400 is to use a nominal cold condition gap of 1.6 mm (1/16 in) on each side of the pipe in the restrained direction." The above DCD statement does not appear to be applicable to pipe restraints that are designed to support deadweight. The applicant is requested to provide additional information on gaps that are used in deadweight support restraints.

03.12-6

Standard Review Plan (SRP) Section 3.12 specifies that when a piping system is to be broken up into two parts with the input from the larger piping system used to analyze the smaller piping system, the decoupling criteria provided in SRP Section 3.7.2 are applicable. APR1400 DCD Tier 2, Subsections 3.7.2.3.2 and 3.7.2.3.3 specify decoupling criteria for piping similar to those in SRP Section 3.7.2. DCD Subsection 3.12.4.4 specifies a choice of two decoupling criteria for piping that are different from the guidance in SRP Section 3.7.2 and those specified in DCD Subsection 3.7.2.3.2.

The following is requested from the applicant:

1. If the branch piping geometry is known, the applicant should clarify whether the branch piping is included in the piping analysis model with the header. If it is not included, the applicant should provide a technical justification for decoupling the branch from the header.
2. For branch piping with known geometry for which decoupling is justified based on the item above, SRP Section 3.12 indicates that decoupling criteria from SRP Section 3.7.2 should be used. The applicant is requested to justify why the decoupling criteria in DCD Subsection 3.7.2.3.2 were not applied for piping.
3. DCD Section 3.12.4.4 includes as one of the decoupling criteria that, if only the size of the branch pipe is known, the branch pipe may be decoupled from the run pipe if the ratio of run to branch pipe moment of inertia is 25 to 1 or more. The Welding Research Council (WRC) Bulletin (BL) 300, “Technical Position on Damping and on Industry Practice,” provides the technical justification for using the moment of inertia ratio of 25 for decoupling with exceptions, which has been accepted by the NRC when justified in certain applications. Since this decoupling criterion is in DCD Section 3.12.4.4, the applicant is requested to refer to and add WRC BL 300 in the DCD Section 3.12 list of references and also show in DCD 3.12.4.4 that, as shown in WRC BL 300, if either of the two factors listed below apply, piping cannot be decoupled. If an alternative approach is selected, the applicant is requested to provide a technical justification.

i. If an anchor or fixed restraint on the branch pipe is located near the run pipe and significantly restrains the movement of the run pipe, the branch pipe should be included with the model of the run pipe, up to the anchor (or up to and including the series of fixed restraints that effectively permits termination of the problem at some point remote from the run pipe).

ii. The branch pipe should be included in the computer model of the run pipe if more precise magnitudes of reactions are required at terminal points (i.e., equipment, penetrations, etc.) to determine their (the reactions) acceptability.

03.12-7

ASME BPV Code Section III, as mandated by 10 CFR 50.55a, requires that the effects of deadweight and seismic loads be accounted for in the piping analysis. In some instances under deadweight and seismic (or any dynamic acceleration) loadings, the piping is supporting the mass of certain supports in the unrestraint direction of the support. During seismic or other type of dynamic accelerations, this pipe support mass moves in directions perpendicular to the axis of the pipe support and if it is not accounted for in the piping analysis model, the results of the piping analysis may not be valid. Examples for this situation are the double pinned type of pipe supports such as snubbers or struts (particularly on small bore lines) or trapeze supports, in which the trapeze mass is supported by the pipe. The applicant is requested to describe how this situation is accounted for in the analysis and design of the APR1400 piping and, if appropriate, revise DCD Section 3.12 to include associated methodology and criteria.

03.12-8

ASME BPV Code Section III, as mandated by 50.55a, requires that piping be evaluated for seismic loads.

DCD Section 3.7.2.7 shows that the combination of modal responses is performed in accordance with the latest (2012) revision of RG 1.92, which is Revision 3. DCD Section 3.7.1.2 shows that damping values are based on the latest (2007) revision of RG 1.61, which is Revision 1. In contrast, DCD Section 3.12.3.2.4 states that RG 1.92 Revision 1 of 1976 and Revision 3 of 2012 are used for combination of modal responses. It also indicates that combination of modal responses with no closely spaced modes is obtained by the square root of the sum of the squares (SRSS). It further states that, for closely spaced modes within 10% of each other or less, the 1976 RG 1.92 Revision 1 NRC-Grouping method is used for combination of modal responses. Thus, the DCD implies that closely spaced modes are only those that are within 10% of each other. The design of APR1400 piping and supports includes loadings due to the safe shutdown earthquake (SSE) in their structural analysis and, because the OBE is set equal to 1/3 of the SSE, loads due to OBE are not required in the design analysis, as described in DCD Section 3.12.5.3.4. DCD Section 3.12.3.2.1 states that the response spectra analysis for piping will use damping values from the 2007 RG 1.61 Rev 1, which specifies 4% SSE damping for piping.

1. The paragraphs above show that guidance from more than one Regulatory Guide is utilized. In DCD Section 3.7, these guides are of comparable issue date, while an earlier version is used for one guide in DCD Section 3.12. The applicant is requested to provide a technical justification for the difference between DCD Sections 3.7.2.7 and DCD Section 3.12.3.2.4, and an explanation for the different combinations of revisions of RG 1.61 and RG 1.92.
2. According to RG 1.92 Revision 3, Section C.1.1.1(1) for critical damping ratios less than or equal to 2%, modes are considered closely spaced if their frequencies are within 10% of each other. According to RG 1.92 Revision 3, Section C.1.1.1(2), for critical damping greater than 2%, modes are considered closely spaced if the frequencies are within five times the critical damping ratio (i.e. for damping of 4%, modes are considered closely spaced if the frequencies are within 4x5=20% of each other). From the above, it can be seen that the closely spaced modes definition of 10% is only applicable to 2% damping, which is reasonably consistent with the damping value for piping in the 1973 revision of RG 1.61. Also, for 4% damping (as specified for SSE piping damping in the 2007 revision of RG 1.61 and which APR1400 utilizes) closely spaced modes are considered those that are within 20% of each other. As shown above, in the APR1400 piping seismic analysis closely spaced modes are not grouped in accordance with the NRC regulatory guidance because for 4% damping, modes are considered closely spaced if the frequencies are only within 10% of each other instead of 20% that the NRC regulatory guidance specifies. Based on the justification provided in response to item 1, the applicant is requested to provide additional information to justify using a definition for closely spaced modes different from that provided in staff guidance, such that the requirements of 10 CFR 50.55a can be demonstrated to be met.
3. The Regulatory Positions section in RG 1.92 Revision 3 includes the following statement: "If applicants for new licenses choose to use RG 1.92 Revision 1 methods for combining modal responses, their analyses should address the residual rigid response of the missing mass modes discussed in Regulatory Positions C.1.4 and C.1.5 of RG 1.92-R3." Based on the justifications provided in response to items 1 and 2 above, the applicant is requested to provide additional information to describe how the piping analysis methodology described in the DCD is consistent with the regulatory positions C.1.4 and C.1.5 of RG 1.92 Revision 3, or to justify an alternative approach.

REQUEST FOR ADDITIONAL INFORMATION 311-8278

03.12-9

ASME BPV Code Section III, as mandated by 50.55a, requires that piping be evaluated for seismic loads. DCD Section 3.7B.7.3 shows that ASME Class 1, 2, and 3 piping systems are evaluated for the hard rock high frequency (HRHF) seismic response spectra. DCD Section 3.7B.1 identifies that the HRHF response spectra exceed the certified seismic design response spectra (CSDRS) for frequencies above approximately 10 Hz.

1. DCD Section 3.7B.7 discusses the HRHF evaluation of selected SSCs. DCD Sections 3.7B.1 and 3.7B6 show that piping is among the SSCs that were selected to be evaluated for the effects of HRHF as part of the design certification application. DCD 3.7B.7.3 though shows that HRHF effects are to be evaluated by the combined license (COL) applicant. The applicant is requested to provide a justification for this inconsistency.
2. For the piping that was selected to be evaluated in the graded approach identified in DCD Section 14.3.2.3, the applicant is requested to clarify whether both CSDRS and HRHF response spectra are included in the completed piping analyses. In the event that the HRHF response spectra was not included in the piping analysis, the applicant is requested to provide a technical justification for its exclusion from the scope of the design certification application.


U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment