

**PIPING ANALYSIS PART OF THE APR1400 DESIGN  
CONTROL DOCUMENT AUDIT PLAN**

**SEPTEMBER 8 - 14, 2015  
and  
OCTOBER 19 – NOVEMBER 4, 2015**

**Korea Hydro and Nuclear Power Co., Ltd. (KHNP)  
and Korea Electric Power Corporation (KEPCO)**

**APR1400 DESIGN CERTIFICATION  
Docket No. 52-046**

Location: NRC Headquarters  
Two White Flint North  
11545 Rockville Pike  
Rockville, MD 20852-2738

KHNP Washington DC Center  
8100 Boone Blvd. Suite 620  
Vienna, VA 22182

Purpose:

The purpose of this audit is for the staff to: (1) gain an understanding of the Advanced Power Reactor 1400 (APR1400) supporting documents to reach a reasonable assurance finding; (2) review related documentation and non-docketed information to evaluate conformance with the Standard Review Plan (SRP) or technical guidance; and (3) verify that the APR1400 piping design stress analyses are performed in accordance with the methodology and criteria described in the APR1400 design control document (DCD), in support of the KHNP design certification (DC) application.

Background:

On March 5, 2015, the U.S. Nuclear Regulatory Commission (NRC) accepted the DC application for docketing for the APR1400 submitted by KHNP (Reference 1). The staff initiated Phase 1 of the application DC review on March 9, 2015.

The NRC staff determined efficiency gains would be realized by auditing the documents supporting the applicant's implementation of the piping stress analysis methodology and criteria as presented in the DCD to verify and ensure that safety related piping meets applicable requirements.

The purpose of this audit is to allow the NRC technical staff to gain an understanding of the supporting documents to better focus staff inquiries to the applicant. During the audit and interactions with the applicant, there may be detailed NRC requests for information developed, which would be part of future formal correspondence.

Enclosure

### Regulatory Audit Basis:

Title 10 of the *Code of Federal Regulations* (10 CFR), Paragraph 52.47(a)(3)(i) states that a DC application must contain a final safety analysis report (FSAR) that includes a description of principal design criteria for the facility. A regulatory audit is needed to evaluate the safety conclusions that need to be made regarding Chapter 3, "Design of Structures, Components, Equipment, and Systems," of the APR1400 DCD, and to identify detailed information related to the applicant's principal design criteria. The NRC staff must have sufficient information to document its safety findings in the NRC staff's safety evaluation report (SER).

This regulatory audit is based on the following:

- 10 CFR 50.55a and GDC 1, as they relate to piping systems, pipe supports, and components being designed, fabricated, erected, constructed, tested, and inspected to quality standards commensurate with the importance of the safety function to be performed.
- GDC 2 and Appendix S to 10 CFR Part 50, with regard to design transients and resulting load combinations for piping and pipe supports to withstand the effects of earthquakes combined with the effects of normal or accident conditions.
- GDC 4, with regard to piping systems and pipe support important to safety being designed to accommodate the effects of, and to be compatible with, the environmental conditions of normal as well as postulated events, such as a LOCA, and dynamic effects.
- Additional detailed acceptance criteria in Section 3.12 of the NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants."

### Regulatory Audit Scope:

The NRC staff intends to review the piping stress analysis reports and related documents.

The NRC staff will conduct this audit in accordance with the guidance provided in NRO-REG-108, "Regulatory Audits" (Reference 2).

### Documents and Information Necessary for the Audit:

Complete piping design analysis stress including fatigue for:

- Class 1 piping: reactor coolant system main loop, pressurizer surge line, direct vessel injection line and shutdown cooling line.
- Class 2 piping: main steam and feedwater piping located inside the containment and extended to the first anchor beyond the outboard isolation valve that designates a Class break.

It should be noted that as part of the audit, there may be a need to review additional data and calculations supporting the basis for the above documents.

Appropriate handling and protection of proprietary information shall be acknowledged and

observed throughout the audit.

Audit Team:

Alexander Tsirigotis, NRO, Mechanical Engineer

Tuan Le, NRO, Mechanical Engineer

Jessica Umana, NRO, Project Manager

Applicant Contacts:

Steve Mannon, AECOM

Harry Chang, KHNP

Special Requests:

The NRC staff requests that KHNP provide:

- searchable electronic copies of the documents described above.

Audit Activities and Deliverables:

The NRC audit team review will cover the technical areas identified in the documents and information section of this audit plan. Depending upon how much effort is needed in a given area, the NRC team members may be reassigned to ensure adequate coverage of important technical elements.

The audit will be conducted from NRC Headquarters via KHNP's electronic reading room; however the audit may also be carried out at KHNP's facilities in Vienna, VA, if the technical information is only retained in hard copy.

Follow up audits at the NRC Headquarters via KHNP's electronic reading room (or at KHNP's facilities in Vienna, VA) may be necessary at various times through September 2016, and will be addressed through separate audit plans.

The NRC Project Manager will coordinate with KHNP in advance of audit activities to verify specific documents and identify any changes to the audit schedule and requested documents.

The NRC staff acknowledges the proprietary nature of the information requested. It will be handled appropriately throughout the audit. While the NRC staff will take notes, the NRC staff will not remove hard copies or electronic files from the audit site(s).

At the completion of the audit the audit team will issue an audit summary within 90 days that will be declared and entered as an official agency record in the NRC's Agencywide Documents Access and Management System (ADAMS) records management system. The audit outcome may be used to identify any additional information to be submitted for making regulatory decisions, and it will assist the NRC staff in the issuance of RAIs (if necessary) for the licensing review of APR1400 DCD Chapter 3 and any related information provided in other chapters, in preparation of the NRC staff's SER.

If necessary, any circumstances related to the conductance of the audit will be communicated to Jessica Umana at 301-415-5207 or [Jessica.Umana@nrc.gov](mailto:Jessica.Umana@nrc.gov).

References:

1. "Letter to Korea Hydro and Nuclear Power Co., Ltd., and Korea Electric Power Corporation – Acceptance of the Application for Standard Design Certification of the Advanced Power Reactor 1400," ADAMS Accession Number ML15041A455, issued March 4, 2015.
2. NRO-REG-108, "Regulatory Audits," ADAMS Accession Number ML081910260, issued April 2, 2009.
3. APR1400 Design Control Document, Revision 0, issued December 2014.
4. SRP Section 3.12, "ASME Code Class 1, 2, And 3 Piping Systems, Piping Components And Their Associated Supports" Revisions 1, issued April 2014.