PROBABILISTIC CONTAINMENT SYSTEMS PROGRAM AS PART OF THE APR1400 DESIGN CONTROL DOCUMENT AUDIT PLAN

JUNE 29, 2015 – SEPTEMBER 30, 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 Advanced Power Reactor 1400 (APR1400) supporting calculations and analysis to reach a reasonable assurance finding, and (2) review related documentation and non-docketed information to evaluate conformance with the Standard Review Plan (SRP) or technical guidance.

Background:

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

The NRC staff determined that efficiency gains would be realized by auditing the documents supporting the calculations presented in the design control document (DCD) in lieu of requests for additional information (RAIs) that the applicant's docket the calculation files. The purpose of this audit is to allow the NRC technical staff to gain an understanding of the supporting calculations 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.

Regulatory Audit Basis:

10 CFR 52.47(a)(3)(i) states that a design certification application must contain a final safety analysis report (FSAR) that includes a description of principal design criteria for the facility. An audit is needed to evaluate of the safety conclusions that need to be made regarding Chapter 6

Enclosure

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 ensure that acceptable risk and adequate assurance of safety can be documented in the NRC staff's safety evaluation report (SER). This regulatory audit is based on the following:

- General Design Criteria (GDC) 4 of Appendix A to 10 CFR Part 50, which requires in part, that the applicant take provisions to accommodate and appropriately protect structures, systems and components (SSCs) important to safety against the environmental conditions, including dynamic effects, that may result from normal operation, maintenance, testing, equipment failures and postulated accidents.

- GDC 38,"Containment Heat Removal," which requires that:

    - The containment heat removal system be capable of rapidly reducing the containment pressure and temperature following a loss-of-coolant accident (LOCA) and to maintain these parameters at acceptably low levels.

    - The containment heat removal system performs in a manner consistent with the function of other systems.

    - The safety-grade design of the containment heat removal system provide suitable redundancy in components and features and suitable interconnections, leak detection, isolation, and containment capability to ensure that, for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available), the system safety function can be accomplished in the event of a single failure.

- GDC 50, which requires in part that the reactor containment structure and its internal compartments accommodate the calculated pressure and temperature conditions resulting from any LOCA.

- 10 CFR 52.47 "Contents of Applications; Technical Information in Final Safety Analysis Report."

- Standard Review Plan (SRP) Sections 6.2.1.1, 6.2.1.2, and 6.2.2.

- Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events."

- Staff Requirements Memo (SRM)-SECY-12-0025, "Proposed Orders and Requests for Information in Response to Lessons Learned from Japan's March 11, 2011, Great Tohoku Earthquake and Tsunami," issued February 17, 2012.

- Guidance for developing, implementing and maintaining mitigation strategies from the Japan Lessons-Learned Project Directorate, JLD-ISG-2012-01, “Compliance with Order EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events,” and methodology to establish baseline coping.

Regulatory Audit Scope:

The staff intends to review documents and supporting calculations related to the evaluation of the APR1400 containment, especially related to the required subcompartment analyses, containment volumes and water holdup, and the means and supporting containment analyses used to mitigate against a beyond-design-basis external event and comply with Order EA-12-049.

The 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:

The following documents are to be made available to the NRC staff, either at the KHNP Washington, DC Center, or in the electronic reading room:

- The documentation informing Table 6.8.2 in the DCD (Reference 3), such as a detailed listing of rooms/compartments in containment with provided volumes, elevations, and flow paths.

- The calculation reports/notebooks related to the subcompartment analysis presented in Tier 2, Section 6.2.1.2 of the DCD (subcompartment analyses).

- The documentation informing DCD 19.3.2.3.3, “Containment Function.” Specifically, GOTHIC model development and Fukushima event analysis calculation(s); and supporting documents and Gothic output files.

This is not a comprehensive list of the documents that the staff will be reviewing as part of the audit, as there may be a need to review additional data and calculations supporting the basis for these documents.

Appropriate handling and protection of proprietary information shall be acknowledged and observed throughout the audit.

Audit Team:

Boyce Travis, NRO Reactor Systems Engineer, Audit Lead
Clinton Ashley, NRO Reactor Systems Engineer
Jessica Umaña, NRO, Project Manager

Applicant Contacts:

Yunho Kim (KHNP)
Harry Chang (KHNP)

Special Requests:

The NRC staff requests that KHNP provide:

- Searchable electronic copies of the documents listed above.
- KHNP personnel to provide any necessary overviews of containment systems DCD information and related documents.

Audit Activities and Deliverables:

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

This audit will be conducted from the 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 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.

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 Chapters 6 and 19 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 James Steckel (NRC) at 301-415-1026 or James.Steckel@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. APR Design Control Document, Revision 0, issued December 2014.