



**KHNP**  
**KOREA HYDRO & NUCLEAR POWER CO., LTD**

520 Yeongdong-daero, Gangnam-gu, Seoul 135-881, KOREA  
Tel: +82-2-3456-2006 / Fax: +82-2-3456-8856  
<http://www.khnp.co.kr>

December 23, 2014  
Document Control Desk  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Attention: Glenn M. Tracy  
Director, Office of New Reactors

10 CFR § 52.45  
Project No.0782  
MKD/NW-14-0036L

**Subject: Korea Electric Power Corporation and Korea Hydro & Nuclear Power Co., Ltd Application for Design Certification of the APR1400 Standard Design**

**Reference: NRC Letter to KHNP (ML13351A417), Korea Hydro and Nuclear Power Co., Ltd., and Korea Electric Power Corporation – Non-acceptance of the application for standard design certification of the APR1400, dated December 19, 2013**

Korea Electric Power Corporation (KEPCO) and Korea Hydro & Nuclear Power Co., Ltd (KHNP) are pleased to submit to the U.S. Nuclear Regulatory Commission (Commission) their Application for certification of the APR1400 Standard Design (Application). The Application provides the information required by Subpart B of 10 CFR Part 52 for the certification of the APR1400 standard design.

The following general information is provided in accordance with 10 CFR § 52.46 and 52.47:

Per 10 CFR § 50.33 (a) through (c) and (j):

- (a) Name of applicants: Korea Electric Power Corporation and Korea Hydro & Nuclear Power Co., Ltd (KEPCO/KHNP)
- (b) Address of applicants:
  - KEPCO - Jeollyeok-ro 55, Naju-si, Jeollanam-do, KOREA 520-350
  - KHNP - 520, Yeongdong-daero, Gangnam-gu, Seoul, KOREA 135-881
- (c) Description of business or occupation of applicants:
  - KEPCO - KEPCO was founded with the objective to facilitate the development of electric power supply in Korea, meet the country's power supply and demands

needs, and contribute to the national economy in accordance with the Korea Electric Power Corporation Act. KEPCO is a market-oriented public corporation under the Act on the Management of Public Institutions. KEPCO's areas of business are based on the aforementioned objectives and include the development of electric power resources, electric power generation, transmission, transformation, and distribution, as well as related marketing, research, technological development, overseas business, investment, corporate social responsibility and use of its property. KEPCO funds APR1400 design certification activities and provides input and directions for top-level policy issues for certification of the APR1400 design.

- KHNP - KHNP is one of the six power generating companies in Korea, accounting for approximately 25% of electricity-producing facilities, hydro and nuclear combined. KHNP operates 24 nuclear power plants and is now constructing four additional nuclear power plants. KHNP provides approximately 30% of the national power supply. KHNP is a wholly-owned subsidiary of KEPCO. KHNP is responsible for all technical and administrative issues related to the APR1400 design certification, including quality assurance. KHNP is the lead applicant for the APR1400 design certification project.

- (j) The Application does not include any Restricted Data or other defense information requiring separation in accordance with 10 CFR § 50.33(j).

This Application is submitted under oath or affirmation of the undersigned as duly authorized by KEPCO/KHNP, as provided in Enclosure 1. The Application consists of the above general information and the following documents being submitted with this letter:

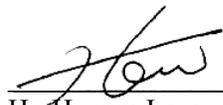
1. The Design Control Document for the APR1400 (DCD) (Enclosure 2). The APR1400 is an evolutionary change from light-water reactor designs of plants that have been licensed and in commercial operation before April 18, 1989. In accordance with 10 CFR § 52.47(c)(1), the DCD provides an essentially complete nuclear power plant design except for site-specific elements such as the service water intake structure and the ultimate heat sink. The DCD was prepared following the guidance of NUREG-0800 and Regulatory Guide 1.206.
  - Tier 2 of the DCD provides the final safety analysis report (FSAR) for the APR1400 standard plant design required by 10 CFR § 52.47(a). The FSAR describes the standard facility, presents the design bases and the limits on its operation, and presents a safety analysis of the structures, systems, and components of the standard facility as a whole.
  - As proposed by KHNP at a pre-application meeting in October 2014, Tier 2\* information has not been designated in the DCD. However, KEPCO/KHNP will discuss Tier 2\* information with the NRC staff during the DCD review phase, then the results will be reflected in a future revision of the DCD.
  - Enclosure 2 contains the DCD, which is being submitted electronically through compact discs (CDs) in two versions: The first version (in CD 1) includes certain information, designated pursuant to Commission guidance as sensitive unclassified non-safeguards information, referred to as security-related information (SRI), that is to be withheld from public disclosure under 10 CFR § 2.390. The second version (in CD 2) omits the SRI and is suitable for public disclosure.

- In accordance with 10 CFR § 52.47(b)(1), the DCD includes Tier 1 – the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a facility that incorporates the certified design has been constructed and will be operated in conformity with the design certification, the provisions of the Atomic Energy Act, and the Commission’s rules and regulations.
2. Applicant's Environmental Report in accordance with 10 CFR § 52.47(b)(2): The Environmental Report is included in Enclosure 2 and is being submitted electronically in the compact disc (CD 2) with the DCD.
  3. Technical Reports that contain analyses and other information that supplement the materials included in the DCD and are considered to be part of the DCD are “incorporated by reference (IBR)” therein. In addition, other non-IBR technical reports are provided with the DCD to supplement information. Enclosure 3 contains the list of the APR1400 technical reports being submitted with the DCD. Each of individual technical reports is being submitted electronically on two separate compact discs in two versions: Proprietary and Non-Proprietary.
  4. Enclosure 4 contains the APR1400 Design ITAAC being applied. Information regarding Design ITAAC is included in both Tier 1 and Tier 2.

KEPCO/KHNP received a letter of non-acceptance of the previous application for standard design certification of the APR1400, dated December 19, 2013. Based on the issues from the letter, KHNP has worked diligently on the DCD to resolve all NRC staff concerns and to develop the necessary information to support a complete application. Furthermore, KEPCO/KHNP had six (6) pre-application meetings with the NRC in 2014. Based on the feedback from the meetings, the completeness of the DCD has been improved by enhancing the level of detail and consistency.

KEPCO/KHNP looks forward to interacting with the NRC in its technical review of the Application for certification of the APR1400 standard design and promptly providing any additional information necessary for the successful completion of the NRC review. Please contact Dr. Myung-Ki Kim, Project Manager, Korea Hydro & Nuclear Power Co., Ltd, if the NRC has questions concerning any aspect of this submittal. His contact information is provided below.

Sincerely,



Ha-Hwang Jung

Executive Vice President

Korea Hydro and Nuclear Power Co., Ltd

520 Yeongdong-daero, Gangnam-gu, Seoul, KOREA 135-881

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Contact Information

Myung-Ki Kim

Project Manager

Advanced Reactors Development Laboratory

Central Research Institute

Korea Hydro and Nuclear Power Co., Ltd

70 Yusung-daero 1312 Beon-gil, Yusung-gu, Daejeon 305-353, Korea

Office: 82-42-870-5700/Cell: 82-10-2737-8915

Email: kimmk89@khnp.co.kr

Enclosures:

1. Oath or Affirmation
2. Design Control Document for the APR1400
3. List of APR1400 Technical Reports
4. APR1400 Design ITAAC Overview

**ENCLOSURE 1**  
**OATH OR AFFIRMATION**

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

In the Matter of

KOREA ELECTRIC POWER CORPORATION and KOREA HYDRO & NUCLEAR POWER  
CO., LTD

Advanced Power Reactor 1400

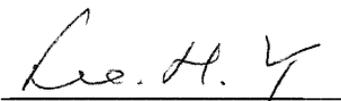
Standard Plant Design Certification Application

**AFFIDAVIT OF HEE-YONG LEE**

I, Hee-Yong Lee, being duly authorized, state the following:

1. I am Executive Vice President & Chief Nuclear Officer of KOREA ELECTRIC POWER CORPORATION (KEPCO).
2. I am authorized to sign and file with the United States Nuclear Regulatory Commission, on behalf of KEPCO, the enclosed Application for Certification of the Advanced Power Reactor 1400 (APR1400) Standard Plant Design.
3. On behalf of KEPCO I state that KEPCO funds the APR1400 design certification activities and provides input and directions for top-level policy issues for the design certification. KEPCO recognizes and agrees that KHNP is responsible for all technical and administrative issues related to the APR1400 design certification, including quality assurance.
4. I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 23rd day of December, 2014

  
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Hee-Yong Lee

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

In the Matter of

KOREA ELECTRIC POWER CORPORATION and KOREA HYDRO & NUCLEAR POWER  
CO., LTD

Advanced Power Reactor 1400

Standard Plant Design Certification Application

**AFFIDAVIT OF HA-HWANG JUNG**

I, Ha-Hwang Jung, being duly authorized, state the following:

1. I am Executive Vice President of KOREA HYDRO & NUCLEAR POWER CO., LTD (KHNP).
2. I am authorized to sign and file with the United States Nuclear Regulatory Commission, on behalf of KHNP, the enclosed Application for Certification of the Advanced Power Reactor 1400 (APR1400) Standard Plant Design (Application).
3. On behalf of KHNP I state that KHNP is responsible for all technical material, including the design, for the Application for the APR1400 design certification.
4. I declare under penalty of perjury that all the statements made in the Application, including the Design Control Document, the Environmental Report, and Technical Reports, are true and correct to the best of my knowledge, information and belief.

Executed on this 23rd day of December, 2014



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Ha-Hwang Jung

**ENCLOSURE 2**  
**Design Control Document for the APR1400**  
**(CD1 & CD2)**

**ENCLOSURE 3**  
**List of APR1400 Technical Reports**

**List of APR1400 Technical Reports**

<b>No.</b>	<b>DCD Chapter</b>	<b>KHNP Report No.</b>	<b>KHNP Report Name</b>	<b>Supports DCD Chapter</b>	<b>IBR</b>
1	3	APR1400-Z-M-NR-14009-P APR1400-Z-M-NR-14009-NP	Comprehensive Vibration Assessment Program for the Reactor Vessel Internals	3.9.2.4	–
2	3	APR1400-Z-M-NR-14010-P APR1400-Z-M-NR-14010-NP	Structural Analysis of Fuel Assemblies for Seismic and Loss of Coolant Accident Loading	4.2	–
3	3	APR1400-E-S-NR-14001-P APR1400-E-S-NR-14001-NP	Seismic Design Bases	3.7.1.1.2 3.7.1.3	–
4	3	APR1400-E-S-NR-14002-P APR1400-E-S-NR-14002-NP	Finite Element Seismic Models for SSI Analyses of the NI Buildings	3.7.2.3.3.1	–
5	3	APR1400-E-S-NR-14003-P APR1400-E-S-NR-14003-NP	SSI Analysis Methodology and Results of NI Buildings	3.7.2.9	–
6	3	APR1400-E-S-NR-14004-P APR1400-E-S-NR-14004-NP	Evaluation of Effects of HRHF Response Spectra on SSCs	3.7B.1	IBR
7	3	APR1400-E-S-NR-14005-P APR1400-E-S-NR-14005-NP	Evaluation of Structure-Soil-Structure Interaction (SSSI) Effects	3.7.2.8	IBR
8	3	APR1400-E-S-NR-14006-P APR1400-E-S-NR-14006-NP	Stability Check for NI Common Basemat	3.8.5.4.3	IBR
9	3	APR1400-E-X-NR-14001-P APR1400-E-X-NR-14001-NP	Equipment Qualification Program	3.10, 3.11	–
10	3	APR1400-H-N-NR-14012-P APR1400-H-N-NR-14012-NP	Mechanical Analysis of New and Spent Fuel Storage Racks	9.1.2	IBR
11	3	APR1400-Z-M-NR-14016-P APR1400-Z-M-NR-14016-NP	Leak-Before-Break Evaluation for Surge Line	3.6.3	–
12	4	APR1400-F-C-NR-12001-P APR1400-F-C-NR-12001-NP	Thermal Design Methodology	4.4	–
13	5	APR1400-Z-A-NR-14015-P APR1400-Z-A-NR-14015-NP	Neutron Fluence Calculation Methodology for Reactor Vessel	5.2, 5.3	–
14	5	APR1400-Z-M-NR-14008-P APR1400-Z-M-NR-14008-NP	Pressure-Temperature Limits Methodology for RCS Heatup and Cooldown	5.2, 5.3	IBR
15	5	WCAP-17942/APR1400-A-M-NR-14001-P WCAP-17942/APR1400-A-M-NR-14001-NP	KHNP APR1400 Flywheel Integrity Report	5.4.1.1	–
16	6	APR1400-Z-A-NR-14007-P APR1400-Z-A-NR-14007-NP	LOCA Mass and Energy Release Methodology	6.2.1.3	IBR
17	6	APR1400-E-N-NR-14001-P APR1400-E-N-NR-14001-NP	Design Features to Address GSI-191	6.2.1.1.2.2 6.8.2.2.1	IBR
18	7	APR1400-Z-J-NR-14001-P APR1400-Z-J-NR-14001-NP	Safety I&C System	7.1, 7.2, 7.3, 7.4, 7.5, 7.8, 7.9	IBR
19	7	APR1400-Z-J-NR-14002-P APR1400-Z-J-NR-14002-NP	Diversity and Defense-in-Depth	7.2, 7.3, 7.7, 7.8	–
20	7	APR1400-Z-J-NR-14003-P APR1400-Z-J-NR-14003-NP	Software Program Manual	7.1.4, 7.2.2.2, 7.3.1	IBR

**List of APR1400 Technical Reports**

<b>No.</b>	<b>DCD Chapter</b>	<b>KHNP Report No.</b>	<b>KHNP Report Name</b>	<b>Supports DCD Chapter</b>	<b>IBR</b>
21	7	APR1400-Z-J-NR-14004-P APR1400-Z-J-NR-14004-NP	Uncertainty Methodology and Application for Instrumentation	7.2.2.7, 7.3.2.7	IBR
22	7	APR1400-Z-J-NR-14005-P APR1400-Z-J-NR-14005-NP	Setpoint Methodology for Plant Protection System	7.2.2.7, 7.3.2.7	IBR
23	7	APR1400-Z-A-NR-14019-P APR1400-Z-A-NR-14019-NP	CCF Coping Analysis	7.7.2.8, 7.8	–
24	7	APR1400-E-J-NR-14001-P APR1400-E-J-NR-14001-NP	Component Interface Module	7.3.1.11 7.3.2.4	–
25	7	APR1400-F-C-NR-14002-P APR1400-F-C-NR-14002-NP	Functional Design Requirements for a Core Operating Limit Supervisory System for APR1400	7.7.1.4	–
26	7	APR1400-F-C-NR-14003-P APR1400-F-C-NR-14003-NP	Functional Design Requirements for a Core Protection Calculator System for APR1400	7.2.1.1	–
27	7	APR1400-Z-J-NR-14012-P APR1400-Z-J-NR-14012-NP	Control System CCF Analysis	7.7.1 7.7.2.3	–
28	7	APR1400-Z-J-NR-14013-P APR1400-Z-J-NR-14013-NP	Response Time Analysis of Safety I&C System	7.2.2.7	–
29	7	WCAP-17926/APR1400-A-J-NR-14003-P	APR1400 Disposition of Common-Q Topical Report NRC Generic Open Items and Plant Specific Action Items	7	–
30	7	APR1400-F-C-NR-14001-P APR1400-F-C-NR-14001-NP	CPC Setpoint Analysis Methodology for APR1400	7.2.1.1	–
31	7	WCAP-17922/APR1400-A-J-NR-14004-P	Common Q Platform Supplemental Information in Support of the APR1400 Design Certification	7	–
32	9	APR1400-Z-A-NR-14011-P APR1400-Z-A-NR-14011-NP	Criticality Analysis of New and Spent Fuel Storage Racks	9.1.1	–
33	13	APR1400-E-A-NR-14002-P	Physical Security Design Features	13.6.2	IBR
34	15	APR1400-F-A-NR-14003-P APR1400-F-A-NR-14003-NP	Post-LOCA Long Term Cooling Evaluation Model	15.6	IBR
35	15	APR1400-F-A-NR-14001-P APR1400-F-A-NR-14001-NP	Small Break LOCA Evaluation Model	15.6	IBR
36	15	APR1400-F-A-NR-14002-P APR1400-F-A-NR-14002-NP	The Effect of Thermal Conductivity Degradation on APR1400 Design and Safety Analyses	15.4 15.6	IBR
37	15	APR1400-Z-A-NR-14006-P APR1400-Z-A-NR-14006-NP	Non-LOCA Safety Analysis Methodology	15.0.2	IBR
38	18	APR1400-E-I-NR-14003-P APR1400-E-I-NR-14003-NP	Functional Requirements Analysis and Function Allocation Implementation Plan	18.3	IBR
39	18	APR1400-E-I-NR-14001-P APR1400-E-I-NR-14001-NP	Human Factors Engineering Program Plan	18.1	IBR
40	18	APR1400-E-I-NR-14002-P APR1400-E-I-NR-14002-NP	Operating Experience Review Implementation Plan	18.2	IBR

**List of APR1400 Technical Reports**

<b><u>No.</u></b>	<b><u>DCD Chapter</u></b>	<b><u>KHNP Report No.</u></b>	<b><u>KHNP Report Name</u></b>	<b><u>Supports DCD Chapter</u></b>	<b><u>IBR</u></b>
41	18	APR1400-E-I-NR-14012-P APR1400-E-I-NR-14012-NP	Style Guide	7.5, 7.7	–
42	18	APR1400-E-I-NR-14004-P APR1400-E-I-NR-14004-NP	Task Analysis Implementation Plan	18.4	IBR
43	18	APR1400-E-I-NR-14007-P APR1400-E-I-NR-14007-NP	Human-System Interface Design Implementation Plan	18.7	IBR
44	18	APR1400-E-I-NR-14011-P APR1400-E-I-NR-14011-NP	Basic Human-System Interface	–	–
45	18	APR1400-E-I-NR-14008-P APR1400-E-I-NR-14008-NP	Human Factors Verification and Validation Implementation Plan	18.10	IBR
46	18	APR1400-E-I-NR-14006-P APR1400-E-I-NR-14006-NP	Treatment of Important Human Actions Implementation Plan	18.6	IBR
47	18	APR1400-E-I-NR-14010-P APR1400-E-I-NR-14010-NP	Human Factors Verification and Validation Scenarios	18.10	–
48	18	APR1400-K-I-NR-14005-P APR1400-K-I-NR-14005-NP	Staffing and Qualifications Implementation Plan	18.5	IBR
49	18	APR1400-K-I-NR-14009-P APR1400-K-I-NR-14009-NP	Design Implementation Plan	18.11	IBR
50	19	APR1400-E-P-NR-14003-P APR1400-E-P-NR-14003-NP	Severe Accident Analysis Report	19.2.3.3.2.3	–
51	ER	APR1400-E-P-NR-14006-P APR1400-E-P-NR-14006-NP	Severe Accident Mitigation Design Alternatives (SAMDA) for the APR1400	ER	–

**ENCLOSURE 4**  
**APR1400 Design ITAAC Overview**

### APR1400 Design ITAAC Overview

Reference No.	Description	DCD Section
ITAAC No. 1 Tier 1, Table 2.3-2	Class 1 Piping and Components Environmental Fatigue Analysis*	Tier 2 Section 14.3.2.3 and Section 14.3.5.2
ITAAC No. 1 Tier 1, Table 2.9-1	Human Factors Verification and Validation Implementation Plan**	Tier 2 Section 14.3.2.9 and Section 14.3.5.3

In accordance with SECY-92-053 dated February 19, 1992 the APR1400 Design Certification Applications makes use of Design Acceptance Criteria (now referred to as Design ITAAC) in two specific areas:

1. Class 1 Piping and Components Environmental Fatigue Analysis
2. Human Factors Verification and Validation (V&V) Implementation Plan

These Design ITAAC are described in Section 14.3.5 of the DCD Tier 2 and are specifically identified as “*Design ITAAC*” in the appropriate ITAAC tables in Tier 1 and are complemented by an “As-Built” ITAAC to verify the satisfactory design implementation and verification by the Combined License (COL) licensee.

These Design ITAAC are sufficiently narrowed (or limited) in scope and contain the prescribed requirements to allow the regulatory staff to conduct the appropriate review on the related systems and draw an appropriate safety determination.

As noted in SECY-92-053, piping and Human Factors Engineering (HFE) are two areas where it is anticipated that insufficient information may lead to a Design ITAAC (previously DAC). While the Reference Plant for the APR1400 (Shin-Kori 3&4) is nearing startup, these two limited Design ITAAC are justified as follows:

#### **\*Class 1 Piping and Components Environmental Fatigue Analysis**

The current guidance for environmental fatigue analysis is given in NUREG/CR-6909, which is endorsed by RG1.207. NUREG/CR-6909 is under revision and industry standards are also under development. The analysis results based on the current guidance of NUREG/CR-6909 may need to be re-evaluated when the new guidance is finalized. Therefore, it is considered appropriate for the Environmental Fatigue analysis to be completed in accordance with the new guidance as a Design ITAAC.

#### **\*\* Human Factors Verification and Validation Implementation Plan**

HFE Design ITAAC verifies final design at a level of detail adequate for procurement and construction. The final design can be validated by V&V since V&V covers all of the other HFE elements. An integrated system validation test will be performed in accordance with the V&V IP to validate final HSI design.