

Lessons Learned from the APR1400 Design Certification



KEPCO/KHNP
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Hansang Kim


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Contents

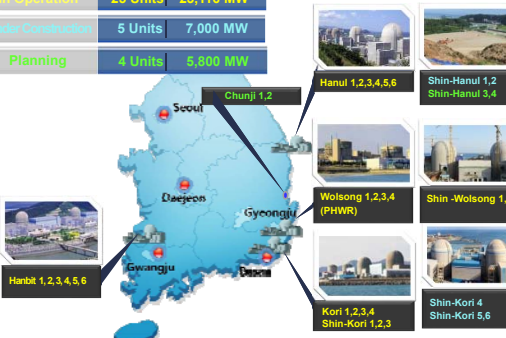
- Introduction
 - NPPs in Korea
 - Project History
- Key Lessons Learned
- Summary

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Nuclear Power Plants in Korea

In Operation	25 Units	23,116 MW
Under Construction	5 Units	7,000 MW
Planning	4 Units	5,800 MW



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Project History and Progress

- [Mar. '09] Letter of Intent to pursue design certification
- [Apr. '10–Oct. '14] 18 times pre-application meetings
- [Sep. '13] Submitted the APR1400 DC application, but not docketed
- [Dec. '14] Submitted again DCA to the US NRC
- [Mar. '15] Docketing of APR1400 DC application
- [Jan. '16] Finished Phase I Review
- [Apr. '16] APR1400 design briefing to APR1400 ACRS subcommittee
- [Jul.–Aug. '16] RAI status review meeting with NRC
- ACRS Full-committee Phase III review on Ch. 2, 5, 8, 10, 11, and two topical reports on FE and CHF were completed.
 - The final ACRS subcommittee meeting for the Phase III review is scheduled in Jun. 2017.

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Design Review Status

- 42 month Standard Review Schedule

Task	Description	Target Date
Phase I	PSER and RAI Completed	Feb. 2016 Jan. 29 2016
Phase II	SER with Open Items Under Review	Nov. 2016 Mar. 2017
Phase III	ACRS Review of SER with Open Items Under Review	Oct. 2017
Phase IV	Advanced SER with No Open Items Under Review	Dec. 2017
Phase V	ACRS Review of Advanced SER with No Open Items	Jun. 2018
Phase VI	Final SER with No Open Items	Sep. 2018

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Preapplication Review Meeting

- 18 times PRMs from Apr. 2010 to Oct. 2014
 - PRM topics were selected considering preparation time and difficulties
- 2 times pre-application audits
 - PRA, Seismic, RP, HFE, I&C, GSI-191

Date	Topics
Apr.21-22 2010	Fuel, core design, PRA, I&C, safety analysis codes, etc.
Sep. 07 2010	PLUS7 fuel, CHF correlation, seismic analysis
Apr.21 2011	Fluidic device, LBLOCA
Nov. 08 2011	Diversity and DID, I&C system TR
Jan.19 2012	HFE TR
Jun.13 2012	Seismic design parameters, SSI, HRHF
Jul.11-13 2012	PRA, I&C design feature, QAPD
Nov.8-9 2012	GSI-191(sump performance evaluation), PRA, I&C

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6




Preapplication Review Meeting

Date	Topics
May 2, 2013	I&C
Jul.23, 2013	GSI-191
Aug. 12-13 2013	TR, HFE, RP
Dec. 11-12 2013	I&C, HFE
Feb.10-11 2014	PRA, ER, I&C, RP, TBN missile, RCP, I&C
May 1-2 2014	CHF, LBLOCA, piping design
May 28-29 2014	Fukushima, I&C, HFE
Jun.18-19 2014	I&C, PRA, RP
Aug.26-28 2014	RP, PSA, ER, I&C, HFE, RCP, TBN, IASCC, RV
Oct. 29 2014	PM meeting

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7




The Reasons Not Docketed

- No Sufficient Information
 - Digital I&C
 - HFE
 - PRA
 - ER
- No Sufficient Level of Detail
 - RCP Design
 - LBB
 - IASCC
 - TBN Missile
 - RV Weld Integrity
 - Radioactive Waste Management
 - Radiation Protection
- No Technical Reports
 - 4 Technical Reports : CVAP, RCP Flywheel, FA Seismic, SFP Criticality

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8



More Complete Design

- APR1400 referenced Shin-Kori Units 3&4.
- APR1400 is an essentially complete design
 - Construction completed in Korea (Shin-Kori Units 3 & 4)
 - OL for Shin Kori unit 3 issued in October 2015
 - Commercial operation of unit 3 started from December 2016
 - Under-construction in the UAE (Barakah Units 1 - 4)
 - OL for Barakah Unit 1 scheduled tentatively in September 2017
- Tier2* items were removed before the DCA

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Environments around KHNP

- KHNP is capable of work out from the construction, start-up and power operation, and maintenance of NPPs.
- Good supply chains in Korea and international networks
- Strong Regulation in Korea
 - Korean regulator adopted NRC's regulatory bases
 - Some regulatory policies were introduced from IAEA and other countries.
 - Periodic Safety Review
 - Stress Test
- Construction and Licensing Experience since early 1970, so far.
- Operation and maintenance experience
 - Familiar with plant operations and maintenance

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Frequent and Open Communication with NRC

- Regular meeting
 - Bi-Weekly PM Conference Call
 - Bi-Weekly Conference Call for PRA Issues
 - Bi-Weekly Conference Call for Ch.3 Issues
 - Bi-Weekly Conference Call for Ch.15
 - Weekly Conference Call for Ch.9
- Clarification meeting
 - Phone call or face-to-face meeting frequently
- Drop-in meeting
 - Staff in WDCC visits frequently NRC to coordinate issues
- Audit
 - Design documents, Piping, Computer code V/V, etc.
- QA inspection
 - GSI-191 issue : 4 findings
 - Computer codes : 4 observations
 - PLUS7 Fuel EOL Testing : 2 observations

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NRC's Transparent and Open Policy

- **NRC Web Site**
 - Repository of knowledge on NRC's work
 - Easy to search information needed
- **ADAMS**
 - Using the ADAMS system to search references was helpful to find the ways to go and save time.
- **Transcripts of the ACRS meeting**
 - Useful to understand what the ACRS members concerns are.
- **Electronic Reading Room**
 - Useful to provide references or supporting documents for staff's review

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12

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Difficulties to the Foreign Applicant

- **Language barrier**
 - Takes comparatively long time to respond RAIs
 - Sometimes misunderstanding happens
- **Time Difference**
 - Phone call meeting in the midnight
- **Long Travel Hours**
 - Jet lag
 - Travel expenses
- **Timely Feedback**
 - The quick feedback to the applicant on the closure of RAIs responded may help the applicant use its engineering resources effectively.

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13

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Introduction

- > NPPs in Korea
- > Design Features
- > Project History

Key Lessons Learned

Summary

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14

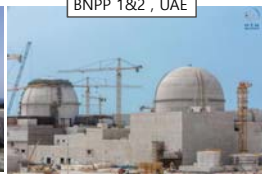
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Summaries

- KEPCO/KHNP is looking forward to completing the NRC review of the APR1400 DCA on schedule.
- The constructability of the APR1400 design has been proven from the construction experience of Shin-Kori Units 3&4 and Barakha Units 1 through 4.
- Minimization of DAC is enhanced by an "essentially complete design" and use of "proven technology" in the DCA.
- Communication with NRC staff is one of the most important factors to minimize trial-and-errors.



SKN 3&4, Korea



BNPP 1&2, UAE

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