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Korean Industry Perspective on CFSI

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Korea Hydro & Nuclear Power Company

KHNP

Nuclear Site in Korea

In Operation	23 units (20,716 MW)
Under Construction	5 units (6,600 MW)
Planned	4 units (5,600 MW)

Radioactive Waste Disposal Facility ('06. 1 ~ '16.12)

Hanbit
1, 2, 3, 4, 5 & 6

Hanul 1, 2, 3, 4, 5 & 6
Shin-Hanul 1&2
Shin-Hanul 3&4(planned)

Wolsong 1, 2, 3 & 4, SWN 1
Shin-Wolsong 2

Kori 1, 2, 3 & 4, SKN 1,2
Shin-Kori 3&4
Shin-Kori 5&6(planned)

Contents

I. Overview

History of Investigation

- **Oct. 2012**, CFSI cases were indentified in Korean NPP
- **End of 2012**, Full-scope investigation of CGD quality doc. was completed
- **From Jan. 2013**, Full-scope investigation of test reports was started
  - ☞ Forged test reports were indentified during the investigation of CGD quality document on Dec. 5, 2012
- **May 2013**, Forged EQ report cases were indentified in SKN/SWN Unit 1,2
  - ☞ SKN Unit 2 & SWN Unit 1 were forced to shutdown on May 28, 2013
  - ☞ Investigation of domestic EQ reports was started
- **Dec. 2013**, The Board of Audit & Inspection announced the investigation result of overseas test reports
- **Feb. 2014**, Basic plan of overseas quality doc. investigation was established
  - ☞ Scope : Safety related items procured during 2008~2013 for 23 operating units

* Investigation plan for construction units was fixed on May 9, 2014

I. Overview

Scope and Methods of Investigation

Investigation of Domestic Test Reports (Completed)

○ **Scope** : Full-scope investigation

· Operating units : Safety related items for 10 years (1 Jan. 2003 ~ 31 Dec. 2012)

· Construction units : Safety related items

○ **Methods** : Check whether an authentic organization issued the test reports

· 1st step : Make the list of test reports and indentify the location of issuing organizations

· 2nd step : Visit issuing organizations directly and compare test reports with original copies

· 3rd step : If falsification is identified, replace the applicable items or perform safety evaluation on them

I. Overview

○ **Follow-up Action**

☞ If any item is identified as “falsified” or “untraceable”, issue NCR and take relevant actions in accordance with the quality assurance procedure

· “Falsified” case :

✓ Replace the item as soon as practicable

✓ If not, perform safety evaluation and then replace it later

✓ Use-as-is if the requirements of test report are met through re-test

· “Untraceable” case :

✓ Take appropriate actions as required for a “falsified” case.

I. Overview

Investigation of Overseas Test Reports (in progress)

○ **Scope**

· Operating units : Safety related items purchased for the last 6 years(2008~2013) in 23 operating units

· Construction units : Safety related items purchased during the construction period of 8 units including SKN #1,2 & SWN #1

	Number of Test Reports	Number of Test Organizations	Number of Countries
Operating Units	About 61,000	About 2,100	About 40
Construction Units*	43,705	2,694	46

* Test reports directly contracted with overseas suppliers

I. Overview

Investigation of Overseas Test Reports (In progress)

○ **Methods** : Check whether authentic organization issued the test reports

· 1st step : Make the list of test reports & identify the location of issuing organizations

· 2nd step : Send E-mails, make phone calls, and visit the organizations

· 3rd step : If identified as “falsified”, replace the items or conduct safety evaluation on them

○ **Follow-up Action**: Take appropriate actions on the same level as domestic investigation

II. Status of Investigation

Result of domestic investigation

○ Test reports

·Operating units : 247 falsified cases(1.1%) were indentified

·Construction units : 1,978 falsified cases(0.9%) were indentified

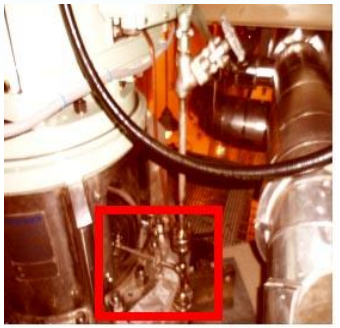
○ EQ reports (28 units) : 62 falsified cases(2.3%) were indentified

○ Typical falsified items

Bolt/Nut

Plate

Angle



Fitting

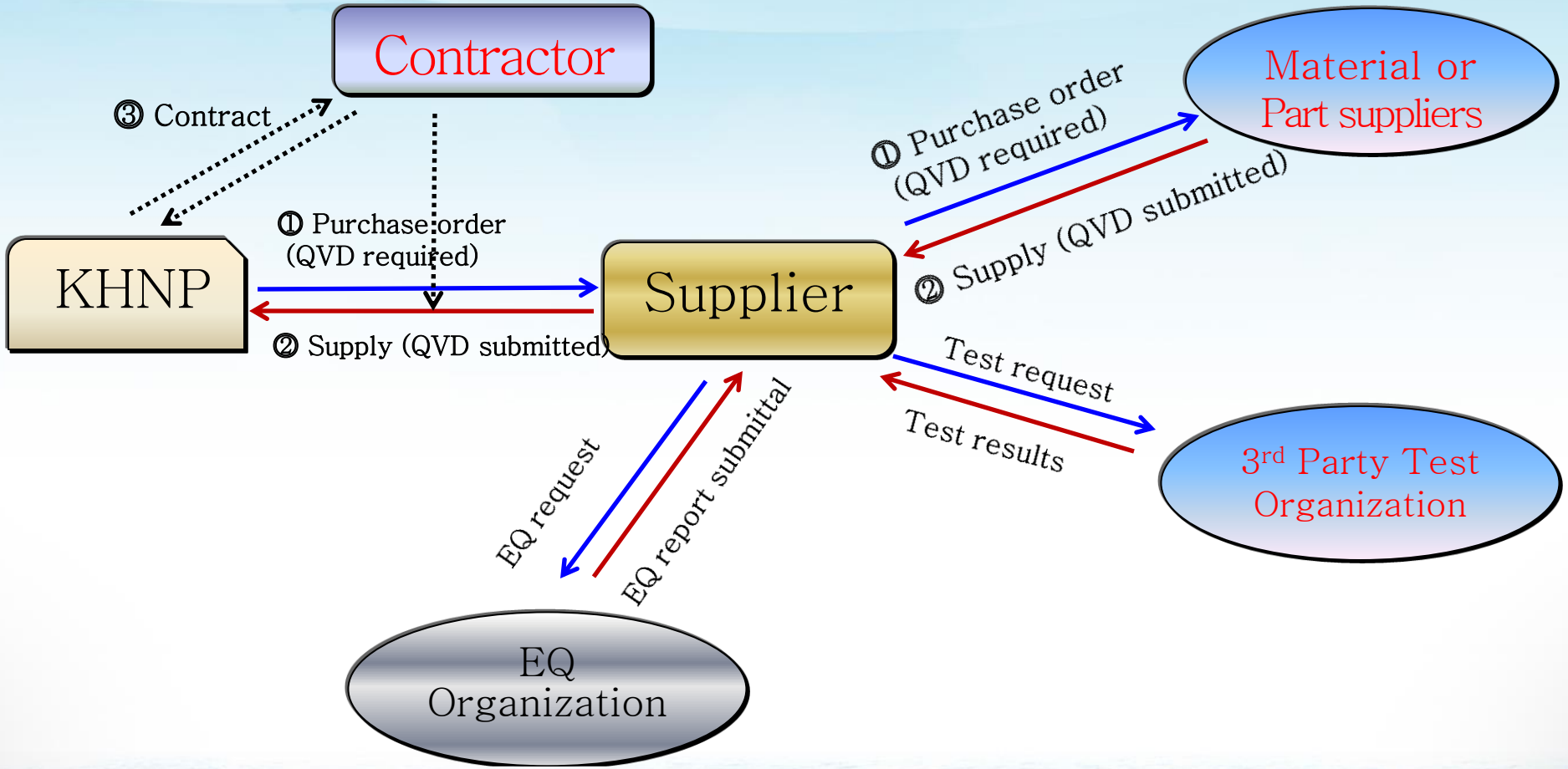
Washer

※ Forged Quality Documents Cases

Scope	Counterfeit Contents	Items
CGD	• Fraudulent quality certificates Issued by agencies	• buzzer, diode, transformer • power supply, switch, fuse • relay, rectifier, magnetic contactor • pressure gauge, blower
QVD	• Reuse of old certificates • Issue of fraudulent certificates • Altered test results	• pulley, fan, motor • pump, bushing, nut, bolt • heater, tool set • ring, sleeve, actuator • filter, valve disk • angle, shaft
EQ	• Altered test results • Change of test conditions (Boric Solution→Normal water) • Altered lab test report by Supplier	• PAR • control switch module • control rod position transmitter • radiation monitoring sensor • AHU • 600V control cable • fuel tank

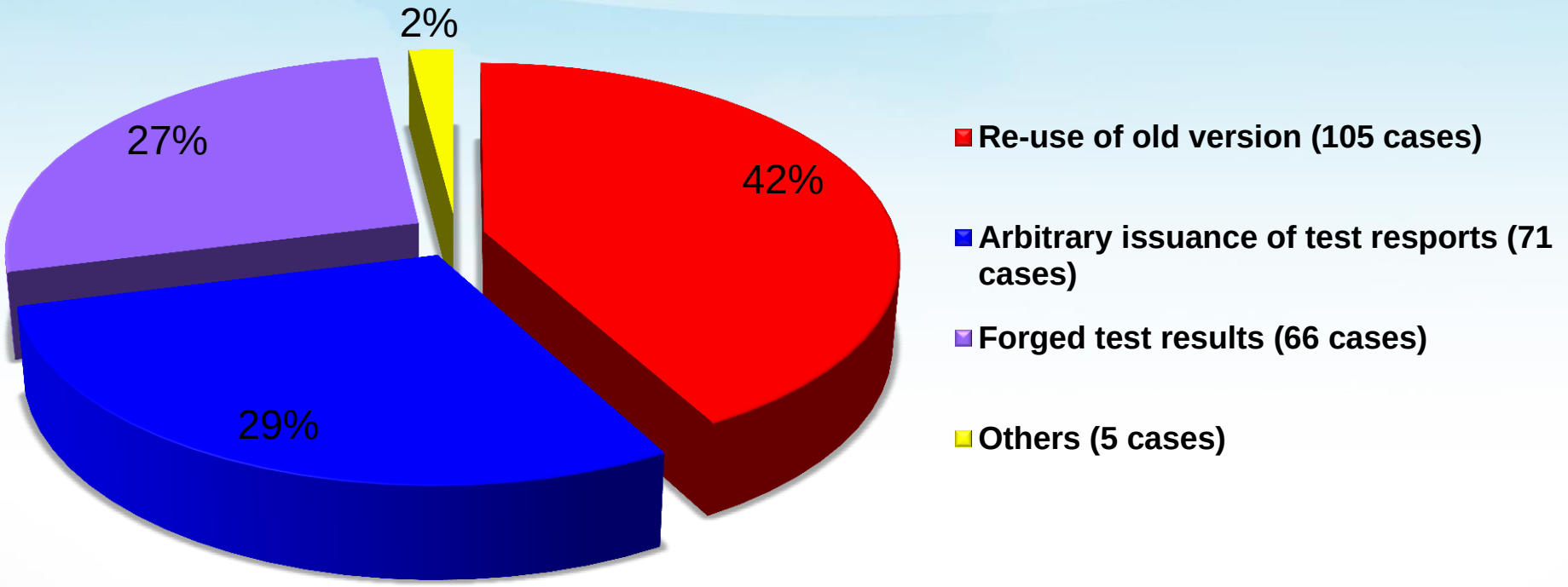
II. Status of Investigation

Typical Supply Chain Process



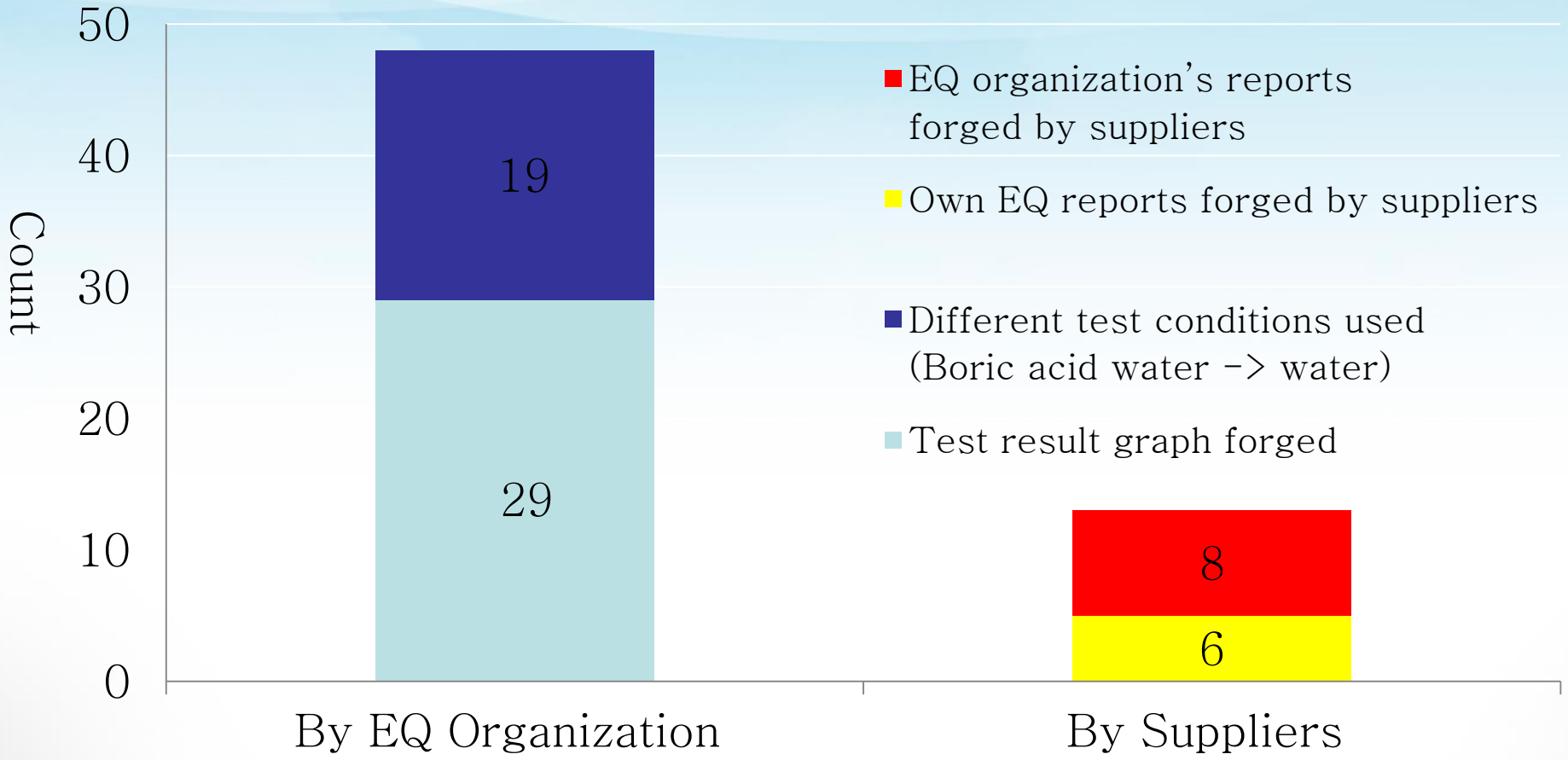
II. Status of investigation

Types of Forged Test Reports



II. Status of Investigation

Types of Forged EQ Reports



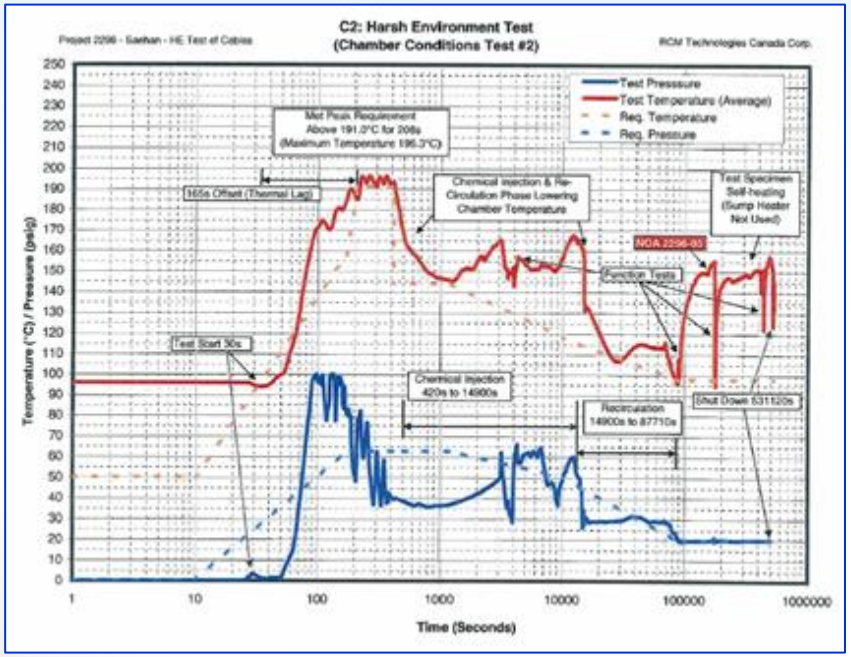
Example of forged EQ document

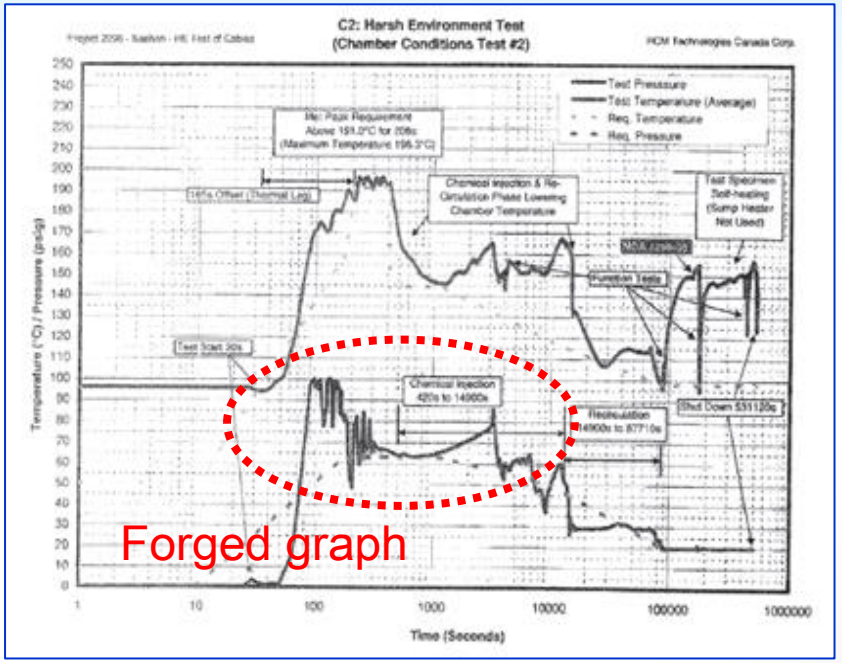
◇ Domestic Test Lab forged EQ document issued by foreign Test Lab

- Domestic test lab requested for LOCA test of control cables to foreign test lab

◇ Forged contents

- Graph of pressure condition and test result





II. Status of Investigation

Major Causes of Falsification

○ Attempt to meet tight delivery schedule or avoid complicated procedure

○ Lack of safety awareness and self-regulation in the nuclear industry

· Lack of awareness on importance of quality document(S/W) with the same level of item(H/W)

○ Limitation and loopholes in KHNP's procurement and management process

New paradigm activities are required to prevent reoccurrence

☞ As-is quality activities are not enough to prevent CFSI

II. Countermeasures against CFSI

Countermeasures by MOCIE*

1. **Introduction of 'Highest Value Bidding System(Qualification-based Screening)' for Safety related materials**

❍ Strengthened technical capability evaluation criteria for bidder screening

◦ (After revision) Tightened screening for actual technical performance, quality assurance capability

2. **Establishment of the 3rd party quality assurance monitoring process**

❍ The 3rd party will verify authenticity of NPP quality documents to be submitted

* MOCIE : Ministry of Commerce, Industry and Energy

II. Countermeasures against CFSI

Countermeasures by MOCIE

3. KHNP's direct payment for EQ test verification cost

❍ Before revision, manufacturers had paid to testing organizations for EQ test. Now KHNP pays for EQ test and verification directly, cutting potential corruptive relations between manufacturers and test organizations.

4. Strengthened self-verification process in KHNP

❍ Establishment of Nuclear Quality Verification Center (Re-organization complete on Dec. 16, 2013)

❍ Establishment of measures to strengthen KHNP self-verification functionality (1st round, '13.10.31)

☞ Development of measures for KHNP to tighten self-verification functionality (draft) and to support to verification by the 3rd party organization

❍ Review & establishment of functions per QVD/EQ/CGD participating organizations in operating/constructed NPP

☞ Re-establishment of roles per participating organization in quality witness inspection, test report review, etc.

- Participants : KHNP, KEPCO E&C, KOCEN, manufacturers (suppliers)

II. Countermeasures against CFSI

Countermeasures by MOCIE

5. Tightened self-regulation in NPP Industry

❍ Operating NPPs

Category	QVD		EQ		CGD	
	Witness	Review	Witness	Review	Witness	Review
Responsible Organization	KHNP (QA)	KHNP (QA)	KHNP (QA)	KHNP (ENG Team)	KHNP (QA)	KHNP (CRI)

❍ Newly constructed NPPs

Category	QVD		EQ		CGD	
	Witness	Review	Witness	Review	Witness	Review
Aux. Equipment	KHNP (QA)	KHNP (QA)	· ENG(KEPCO E&C) · QA(KHNP)	KEPCO E&C	KHNP (QA)	KEPCO E&C
Main Equipment	KHNP (QA)	KHNP (QA)	· ENG(DHIC*) · QA(KHNP)	KEPCO E&C	KHNP (QA)	DHIC

* DHIC : Doosan Heavy Industries & Construction

II. Countermeasures against CFSI

Countermeasures by KHNP

1. Improvement of Procurement, Contract and QA System

- ❍ Establishment and operation of the integrated procurement organization for HQ/Plants (Feb. 2013)
- ❍ Establishment and operation of the multiple-layered supervision system (2013~)
  - ◦ QA organization supervises procurement organization
  - ◦ Audit organization supervises overall activities of the QA and procurement organizations
- ❍ Establishment of IT system for equipment/material tracing (Feb 2013, KHNP)
  - ◦ History and tracing management of all processes regarding material and equipments (In-stock→Delivery→Use→Dispose)
  - ◦ Traceability enhancement by using mobile, tagging and QR codes on materials for disposal
- ❍ Appointment of external experts to Head of Procurement/Quality department (Feb 2013)

2. Tightened disqualification of counterfeiting suppliers

- ❍ Extended disqualification period for counterfeiting suppliers (1yr→10yrs) and reporting to the prosecution

II. Countermeasures against CFSI

Countermeasures by KHNP

3. Issuing organization to submit test results to KHNP

- ❍ Comparison of hardcopy and original version to verify counterfeit during the receipt inspection
- ❍ Registration of test results in digital system using QR code
  - * More effective ways are under review such as recognition of a test result loaded to webpage of the issuing organization as the original version

4. Strengthen manufacturing and receipt inspection for CFSI (2012.11 ~ present)

- ❍ Inspection during manufacturing and final inspection
  - ◦ Verify CFSI prior to signing by contractor and KHNP inspector
- ❍ During receipt inspection
  - ◦ Compare contractor's copy to original version submitted to KHNP by test organization

5. Registration of domestic CGD specialized organization

- ❍ Survey of Suppliers' own CGD program to KHNP's AVL
- ❍ The 3rd party quality verification specialized organization: KPS* registered (End of 2013)

* KPS : KEPCO Plant Service & Engineering Company

II. Countermeasures against CFSI

Countermeasures by KHNP (planned)

1. Tightened Self-verification of suppliers

❍ Tightened requirement for contractors to submit self-verification base documents and certificates

◦ Improvement, strengthening and refinement of procurement contract requirement

2. Improvement of KHNP's own verification process

❍ Review on overseas cases, adopting different methods before and after receipt inspection

◦ Implementation of strengthened verification methods of regulatory body(NSSC/KINS)

3. Reinforcement of Nuclear Quality Verification Organization in KHNP QA Office

❍ Nuclear Quality Verification Center newly added to QA office (Dec. 2013)

◦ Currently with 10 personnel, 8 experts to be added

IV. Lessons Learned

- ✓ Need to strengthen the lax control system for supplier's QA document
- ✓ Need to innovate quality concept across the nuclear industry
- ✓ Chance to enhance public reliability and acceptability for NPP
  - ○ Necessary to create a circumstance transparent and opened to the public at every stage
- ✓ Need to strengthen the domestic and international co-operation for thrust-building in the nuclear industry
  - ○ Utilize experiences of international organizations : EPRI, NEI, NUPIC, NRC, IAEA

Question?

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