



KORI #1

Reactor Vessel Head

Replacement

2014. 09.

KHNP

KORI NPP 1

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1. Outline

Replacement of KORI #1 RVH(Reactor Vessel Head) is the 1st case in Korea(12APR13 ~ 06OCT13)

- Focus on radiation protection
- Establish emergency response plan
- ALARA

※ RVH(Reactor Vessel Head)

1. Outline

1) RVH has been replaced many times since 1991(Bugey, France) to prevent the corrosion and leakage

2) Pipe of RVH of KORU #1 was made by Alloy 600

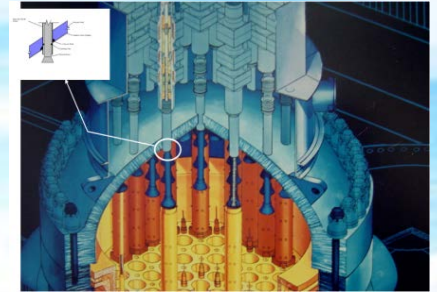
- weak in PWSCC

- reach to EDY

3) Alloy 690TT(strong in PWSCC) was confirmed for continued operation

※ PWSCC(Primary Water Stress Corrosion Cracking)

※ EDY(Effective Degradation Year)



2. Organization

	KHNP	Contractor	Total
Worker	23	101	124

※ Contractor : Doosan heavy industry, Hyundai E&G, Hana I&E, etc

3. Facility

- Hot Machine Shop
- Mock-up Training facility
- RVH warehouse
- Material warehouse
- Packing for Radioactive Material
- Platform

3. Facility

Hot Machine Shop : ORVH storage

Radiation Monitoring Equipment in Hot Machine Shop

Store ORVH in Room #107,
Hot Machine Shop

- ADR System
- Portal Monitor
- RMS
- Portable Radiation measuring instrument

In/Out View



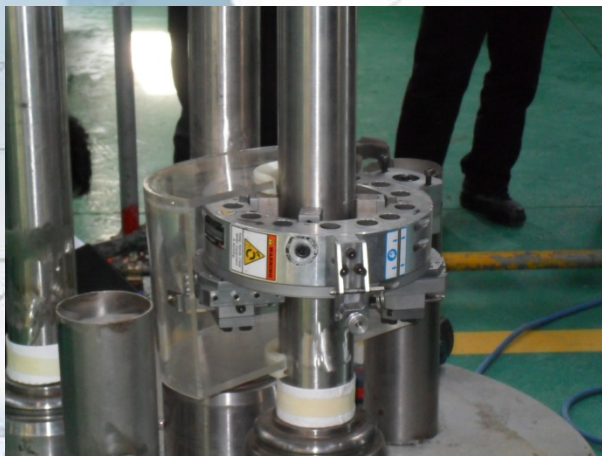
3. Facility

Mock-up Training Facility

- CRDM Housing cutting work
- C/V concrete wall cutting work
- Transport of ORVH

- Use proper equipment
- Establish mockup plan
- Anticipate work population
- Inhance workmanship

Training View



3. Facility

NRVH warehouse

- Store NRVH
- Warehouse is made by steel sheet

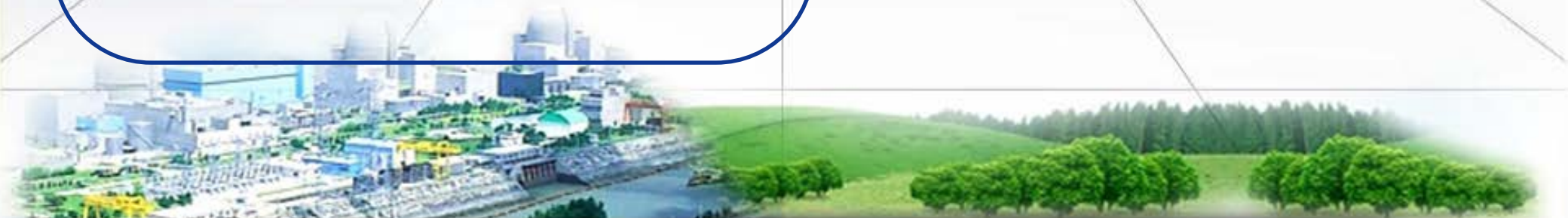
NRVH warehouse view



3. Facility

Material warehouse

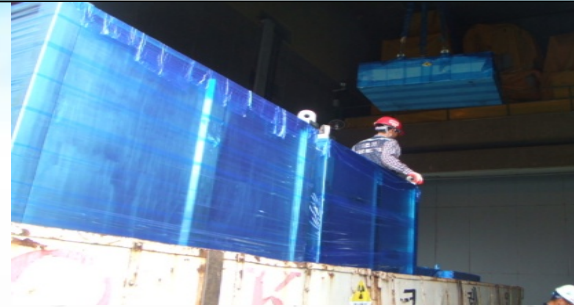
- **Set warehouse as Temporary Radiation Controlled Area**
- **Store replacement equipment of RVH**



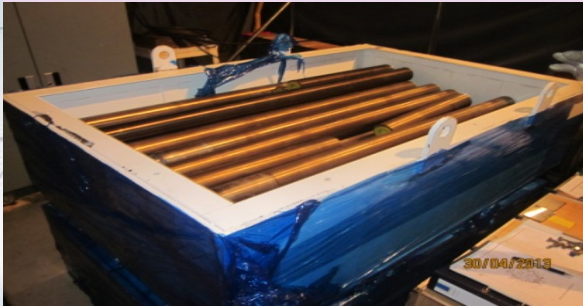
3. Facility

Packings(Type A)

Packing(Type A)



In-ner Box



4. Training

Mock-up Training

- CRDM cutting
- Concrete wall cutting
- Transport ORVH

Education

- 1st : Radiation Protection Training
- 2nd : Industry Safety Training

4. Training

Education



- **Radiation Protection Training**
Teach to ORVH workers by KHNP & KANS



- **Industry Safety Education**
Experience 3D virtual safety education

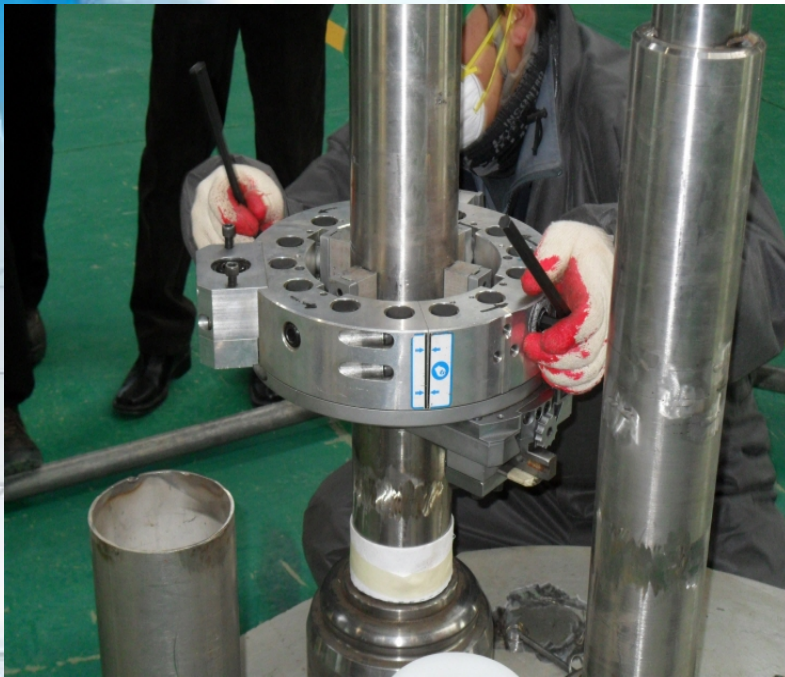


- **ORVH Transport Education**
Inform of safety obedience

4. Training

CRDM cutting Mock-up

CRDM cutting



4. Training

Concrete wall cutting Mock-up

wall cutting



4. Training

Transport ORVH Mock-up

PJB



Survey route



TLD



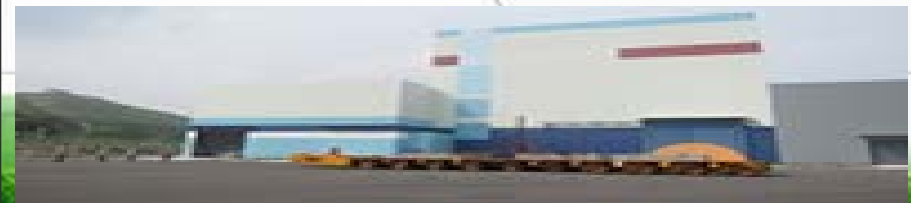
Through KORI 1



Slip test



Arrive at Hot Machine Shop



5. Work Procedure

Prepare procedures related to replacement of RVH

- ALARA procedure
- Transport ORVH procedure
- ORVH emergency response procedure
- ORVH radiation shielding procedure
- Radioactive waste management procedure
- Decontamination procedure

6. Dose Management

Total Dose(man-mSv)

120.76

Work	Dose (man-mSv)
Disassemble ORVH	70.71
Assemble NRVH	10.14
Disassemble misc. in C/V	14.06
Install platform	0.69
Cut CLP	3.01
Transport ORVH	1.07
Radiation Protection	16.41
ETC	4.67
Total	120.76

7. Radiation Work Permit

Work	SRWP	RRWP	ERWP	Total
Disassemble ORVH	16	20	0	36
Assemble NRVH	3	19	0	22
Disassemble misc. in C/V	0	7	0	7
Install platform	0	1	0	1
Cut CLP	0	17	0	17
Transport ORVH	0	0	5	5
Radiation protection	2	10	0	12
ETC	0	6	0	6
Total	21	80	5	106

- ※ SRWP : Specific Radiation Work Permit
- ※ RRWP : Regular Radiation Work Permit
- ※ ERWP : Extended Radiation Work Permit

8. ORVH Licensing

RVH replacement

Request : JUN11 ~ DEC12

Approve : APR13

Special approval of transport

Request : 28DEC12

Approve : 08MAY13

Transport : 16MAY13

Hot Machine Shop

Approve : NOV12

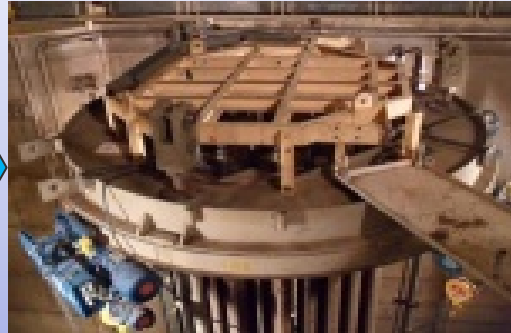
Set RCA : 15MAY13

9. Work Process

Work flow



Reactor Head Stand



Disassemble CSS



Disassemble Seismic Plate



Withdraw RPI



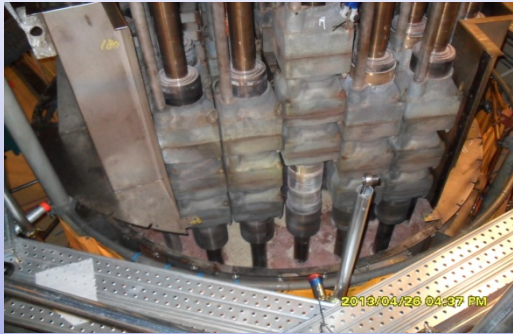
Transport RPI



RPI storage

9. Work Process

Work flow



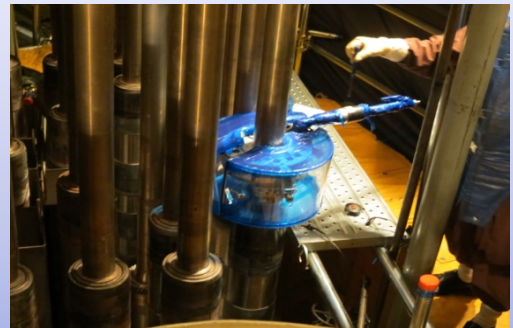
Withdraw Coil Stack



**Dummy Can
withdraw & storage**



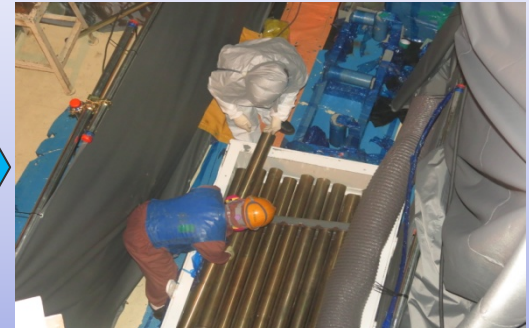
Disassemble Shroud



**Rod Travel Housing
automatic cutting**



**Rod Travel Housing
manual cutting**



Put Rod Travel Housing

9. Work Process

Work flow



Take ORVH out



Put NRVH



Disassemble Shipping Container



Assemble NRVH

9. Work Process

ORVH decontamination by water

- Watering spot : Bottom side
- Location : C/V L-5 Low Cavity upper
- Duration : 10minutes

Decontamination



9. Work Process

Install lead plates

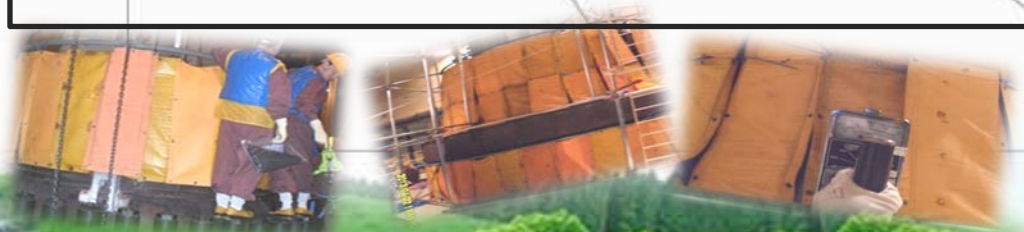


Spec(Lead plate)

- Qty: 160
- Size : 1.1m x 0.4m(12kg)

Shielding

- Before : 0.1 ~ 0.3 mSv/hr
- After : **0.03 ~ 0.05 mSv/hr**

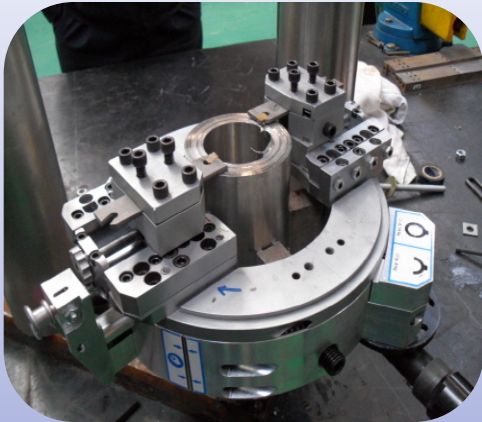


9. Work Process

CRDM(Rod Travel Housing) Cutting

Main work

- HEPA Ventilation System
- Install temporary tent to prevent diffusion
- Wear radiological protection equipments(mask, etc)



9. Work Process

ORVH Sampling

- ORVH Crud Sampling(Smear 3Point, Scratch 3Point)
 - Head Up, Middle, Bottom
- Rod Travel Housing Sampling(3EA, Random)
 - Latch Housing(Canopy Seal) Cutting

Sampling



9. Work Process

ORVH transport & storage

ORVH is moved by trailer

(length : 12.8m, width : 3.0m)

Distance : 1.4km (from KOR1 #1 to Hot Machine Shop)

- Focus on radiation protection
- Set TLD at 9 hot spot



9. Work Process

C/V temporary wall cutting

- Install CCTV
- Install shielding curtain
- Operate contamination air monitor (SPM-100)
- Survey & Wrapping
- Set temporary RCA



10. Rad Waste Management

- Decontamination of misc.
- Rad waste active drums
except for ORVH, CRDM, etc

10. Rad Waste Management

Name	Pic	Qty	Dose (mSv/h)	Contamination (Bq/cm ²)
ORVH		1	20 / (15) (shielding point)	6.48 ~ 123.93
CRDM		33EA	0.5 ~ 2.0	89.3 ~ 111.6
Stud Bolt		48EA	0.003	0.45 ~ 3.95
Assemble Coil Stack		4Set	0.003	0.39 ~ 1.06



GRATITUDE

