HOT TOPIC REPORT OF BOTTOM HEADER DEFECTD, YGN 5 IN 2003

KOREA HYDRO AND NUCLEAR
POWER COMPANY

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General Description

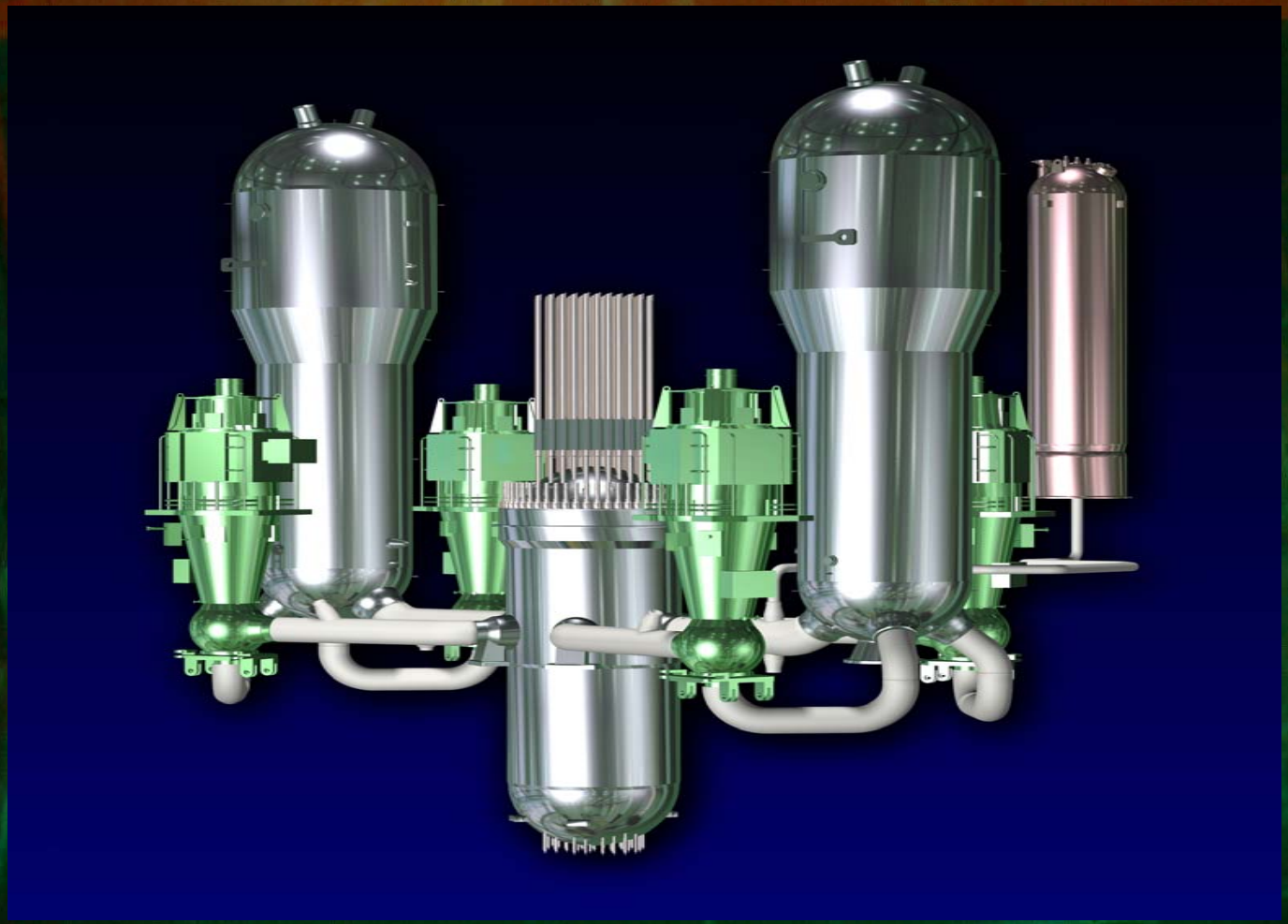
The mechanical department founded that three of eight thermal sleeves were separated from the safety injection nozzle during one cycle life of outage(’03. 03. 17~05.28)

Damaged two location at the surface of RX Bottom

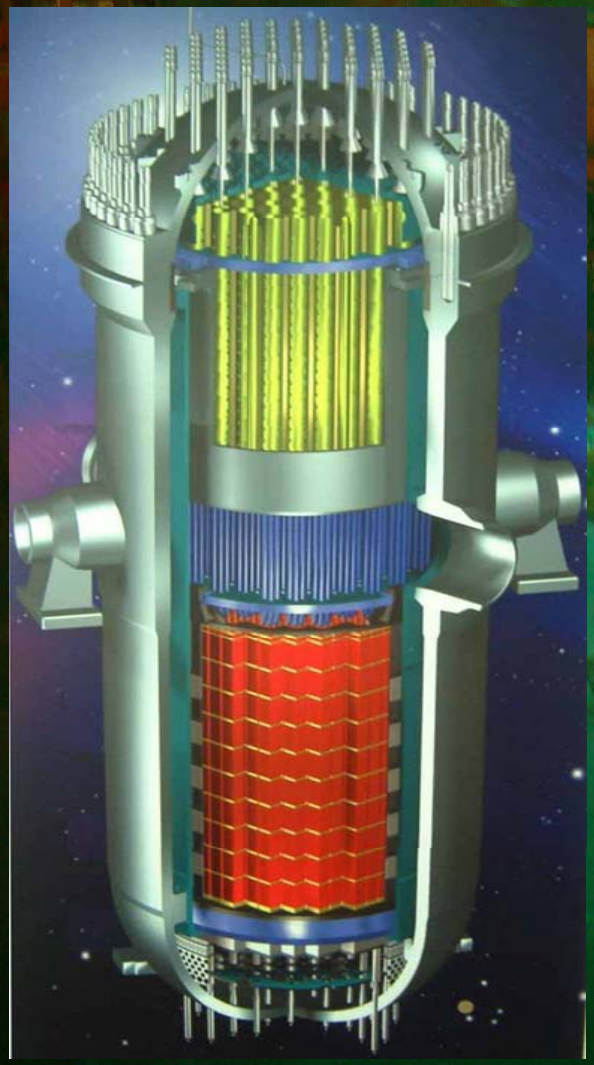
There is no problem in relation with RX vessel integrity

It is necessary to keep ALARA program both the aspect of appropriate time and the aspect of allowable limited exposure radiation

GENERAL ARRANGEMENT OF REACTOR COOLANT SYSTEM



Design of RX Vessel

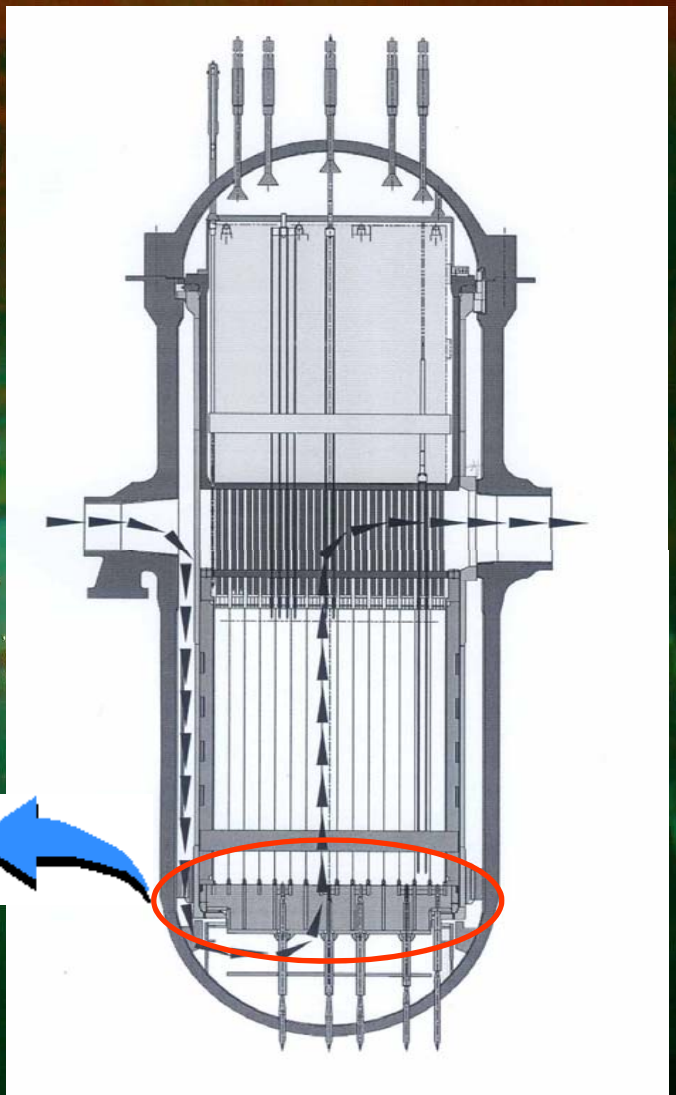


- Rx vessel
  - Upper Head= Closure Head
  - Lower Head= Bottom Head
  - Rx Vessel Body
- Internals of RX
  - Core Support Structure
  - Lower Support Structure
  - Upper Guide Structure

FLOW PATH INSIDE RX

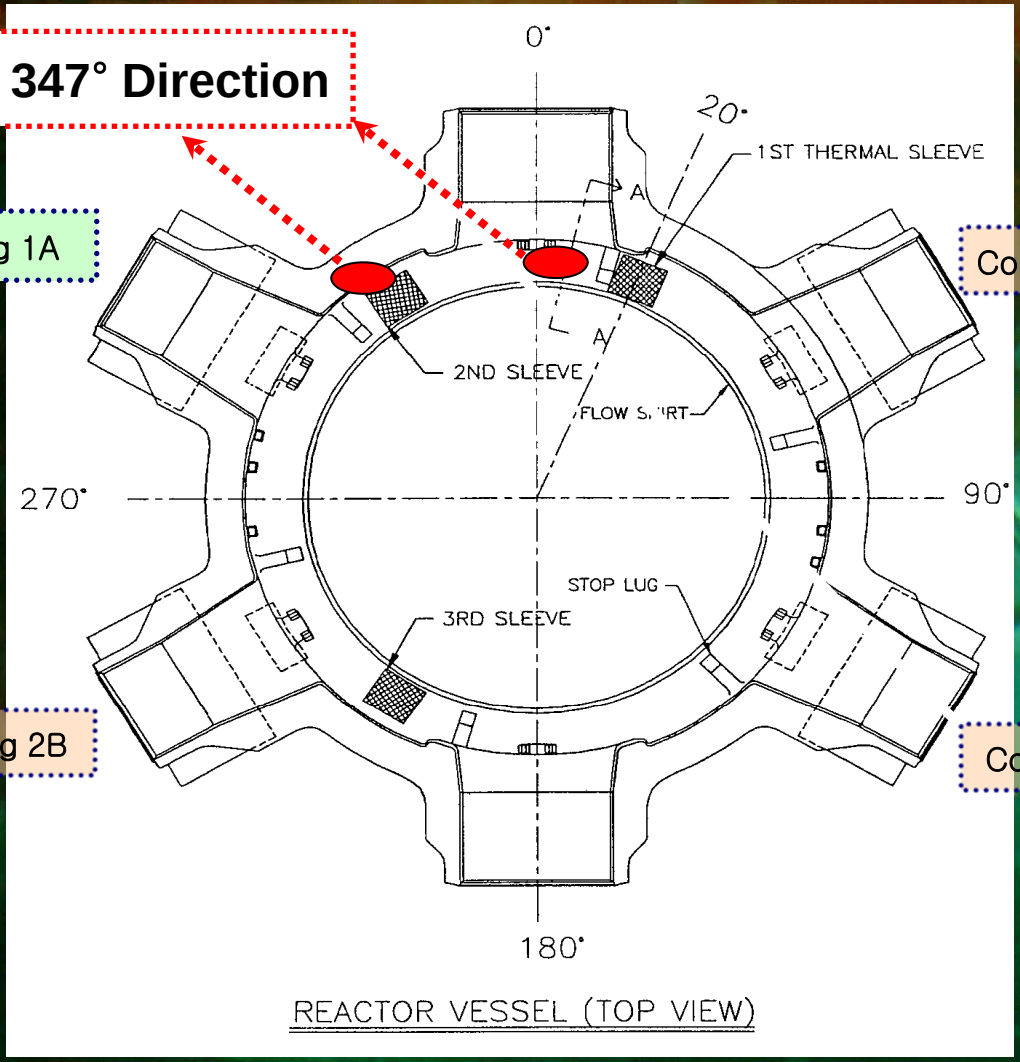
RX Inlet Nozzle

- Flow Skirt
- Fuel Assembly
- RX Outlet Nozzle



Location of Bottom Head Defected

2° and 347° Direction



Cold Leg 1A

Cold Leg 1B

Cold Leg 2B

Cold Leg 2A

The total number of thermal sleeves : 7 EA

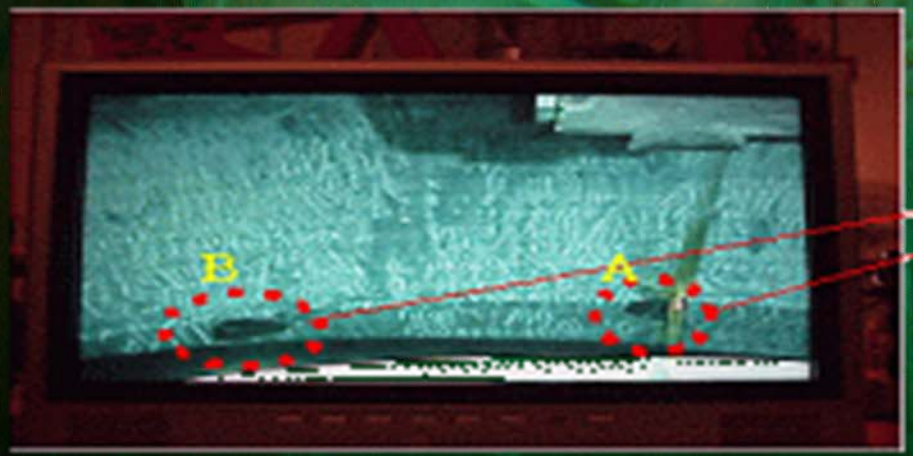
- Cold leg : 4 Location
- PZR Surge Line
  : 2 Location
- Charging Nozzle
  : 1 Location

[Picture 4] The Photography for Bottom header defected at Rx Vessel

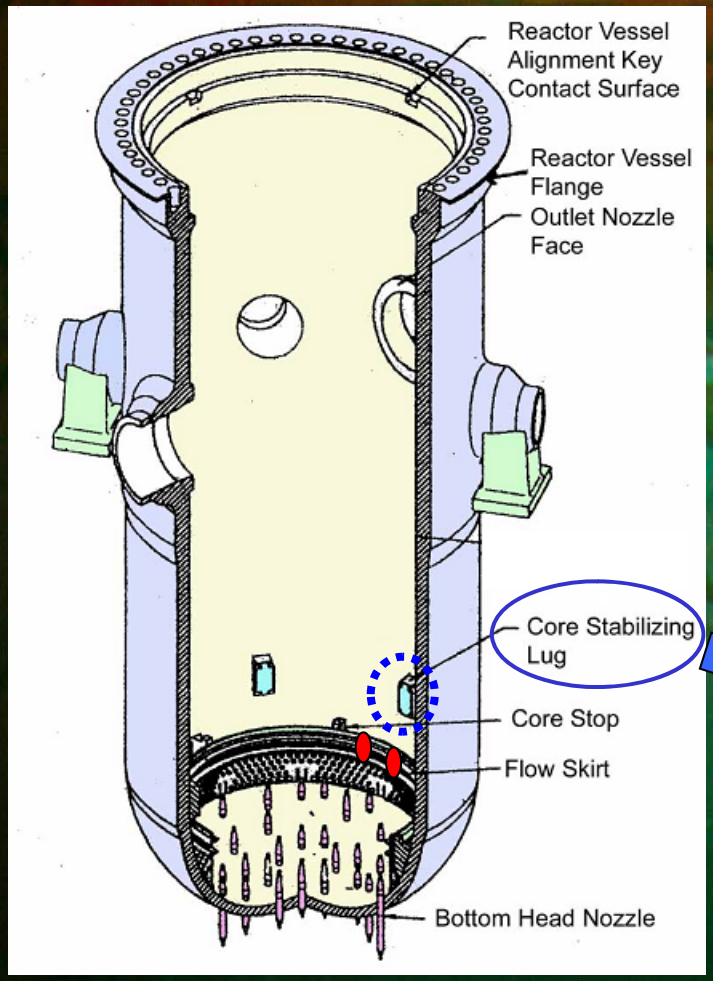
The size of Bottom Head Defected

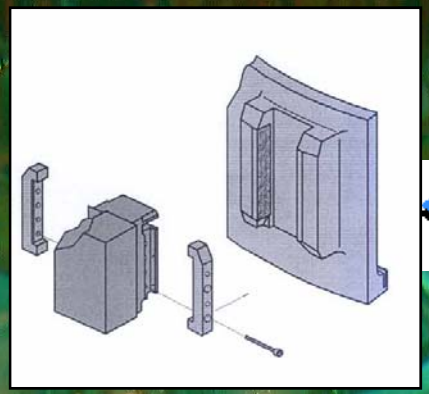
Location Of Defect	Size of Defect (unit : mm)			Remark
	Length	Width	Maximum Depth	
# A	70	93	6.3	
# B	90	74	6.8	

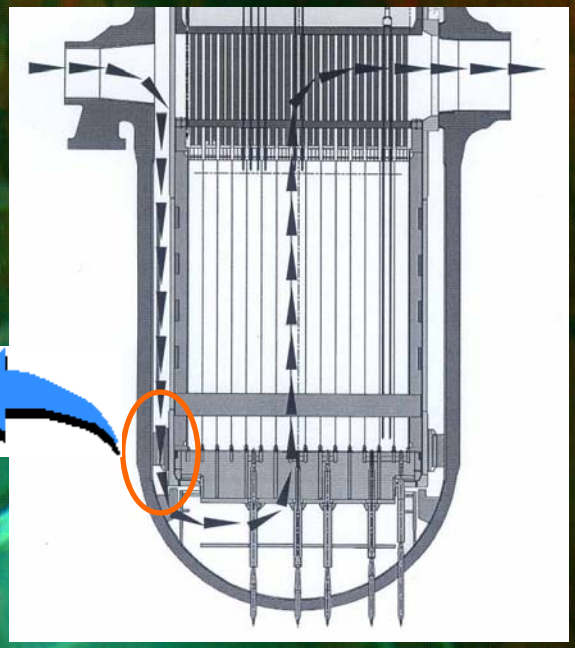
The Photography for Bottom Head Defected



Location of Bottom Header Defected







Radiation Dose Control

- Guide line radiation dose control in accordance with ICRP 60 ALARA program
- Emphasized upon two aspects both management of radiation control and achievement of repairs successful
- It is expected to be taken total 459 man-hours and 55.8 Collective man-mSv

Radiation Dose Control

Radiation Instrument

- Name : **HI HI TELETECTOR**
- **Model : IF104**
- **Type : GM Tube**
- **Range : 0.1mGy ~ 300Gy**

RADIATION DOSE CONTROL

Radiation Instrument

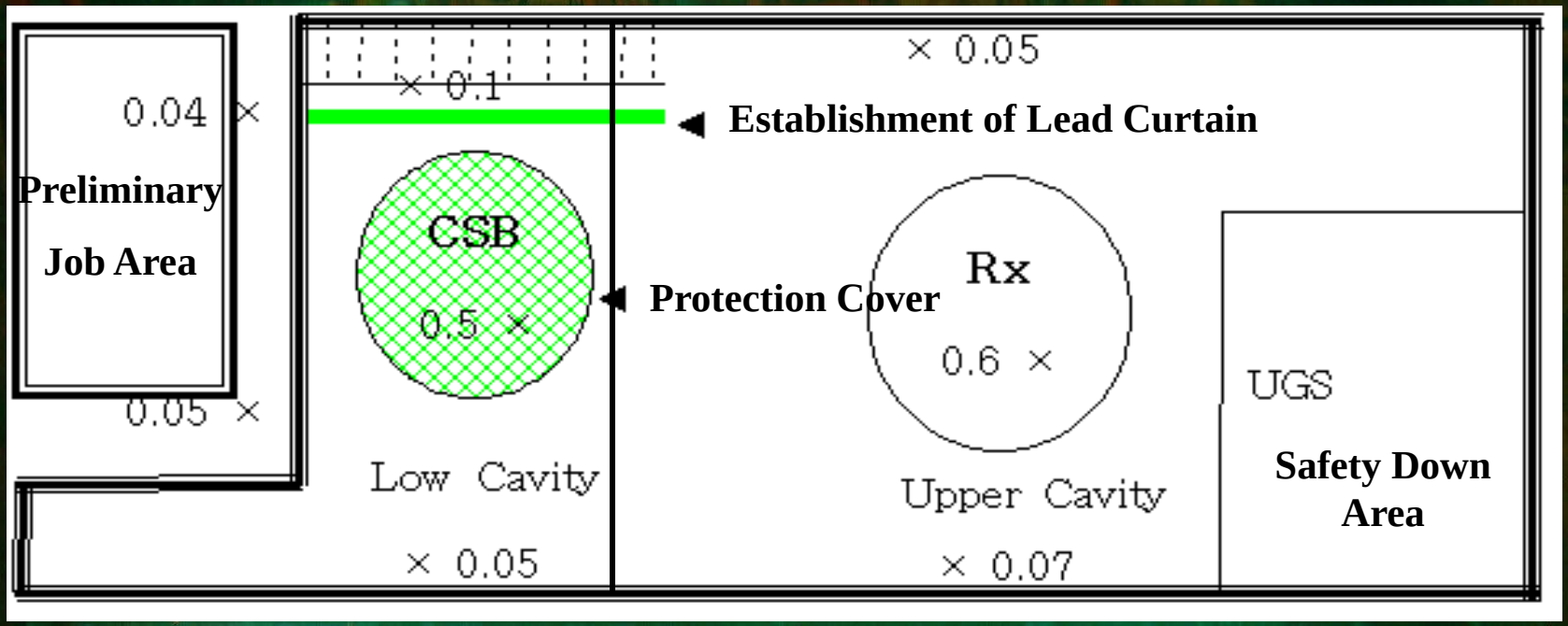
- Name : **TLD**
- **Model : Harshaw 6600**
- **Type : 7776**
- **Range : 0 ~ 2000 rem**

- **Name : ADR**
- **Type : GM**
- **Range : 0 ~ 100 rem**

Survey of Radiation dose Around RX Cavity

RX Cavity with
Full Water (140')

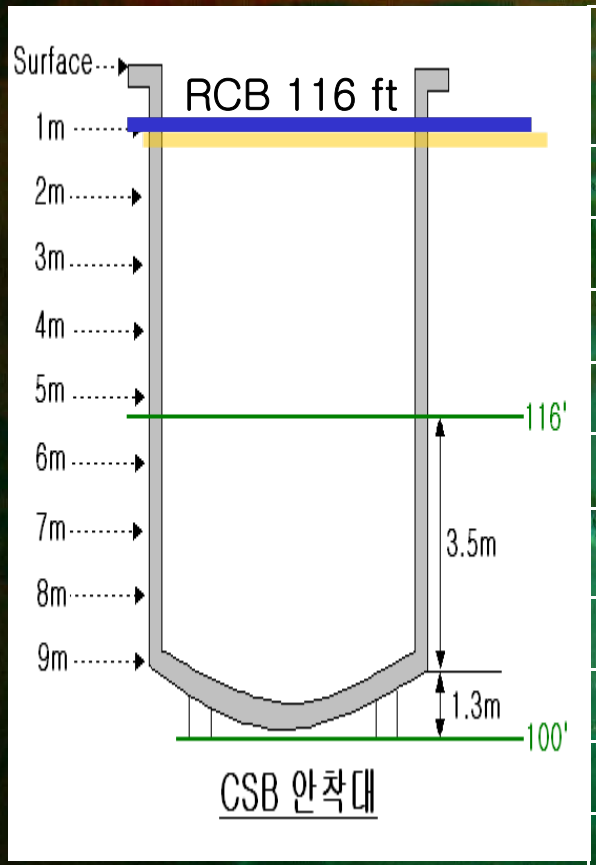
Unit:(mSv/hr)



Radiation Dose at RX Bottom Head Defected

◎ Data of survey (Underwater Detector)

Unit:(mSv/hr)



Location	Inside wall					Outside wall				
	1st	2nd	3rd	TLD	ADR	1st	2nd	3rd	TLD	ADR
Surface	2.8	2.7	3.0	4.0	4.0	8.4	3.4	1.5	3.5	5.8
1m	4.2	4.4	4.2	-	-	1.3	1.6	1.1	-	-
1.9m	4.9	5.1	4.7	2.4	2.6	1.3	1.3	1.3	1.0	0.9
3m	5.1	4.3	5.2	-	-	3.0	2.8	2.1	-	-
3.9m	15.8	23.4	9.0	16.9	1.52	4.0	3.6	2.2	1.8	1.8
5m	44 Sv/hr	38 Sv/hr	89 Sv/hr	-	-	1,520	1,627	1,170	-	-
6m	5.1m – 120Sv			-	-	6,630	6,537	5,707	-	-
7m	It's impossible to measure dose rate more than 5.1m			-	-	6,718	6,776	6,120	-	-
8m				-	-	7,442	6,947	6,500	-	-
9m				142.4 Sv/hr	70.6 Sv/hr	3,620	3,546	7,880	3.42 Sv/hr	3.49 Sv/hr

The Level of Radiation Dose Rate

Location of Survey	Maximum of Dose Rate (mSv/hr)	The survey monitor
The Upper Distance (10 cm) away from stabilizing Lug	1,902	Hi-Hi Telector (GM tube)
10.9 m Height Location from the inside bottom Head	2,500	
Around Side at 115 ft (standard elevation)	1.80	

Radiation dose rate between before and after shielding

Section	Before Shieding (mSv/hr)	After Shielding (mSv/hr)	Thickness Of Shielding(cm)	Reduction rate
Water	1,902	900	30	1/2.1
Tungsten		0.99	14	1/2,068
Iron		1.09	22	1/1,745

Repair Schedule of Bottom Header Defected

1. Manufacturer

   a. Management : GENE company (General Electric Nuclear Energy)

   b. Welding under water : UCC company (Underwater Construction Corporation)

2. Procedure of Maintenance

   The bottom Header defected will be conducted in accordance with the sealing welding under water and NDE procedure equipped with attaching seal plate after performing smoothly with Ring shaped

3. Total number of personnel(GENE/UCC) : twenty two people in number

   a. Project Manager and Supervisor : three people in number

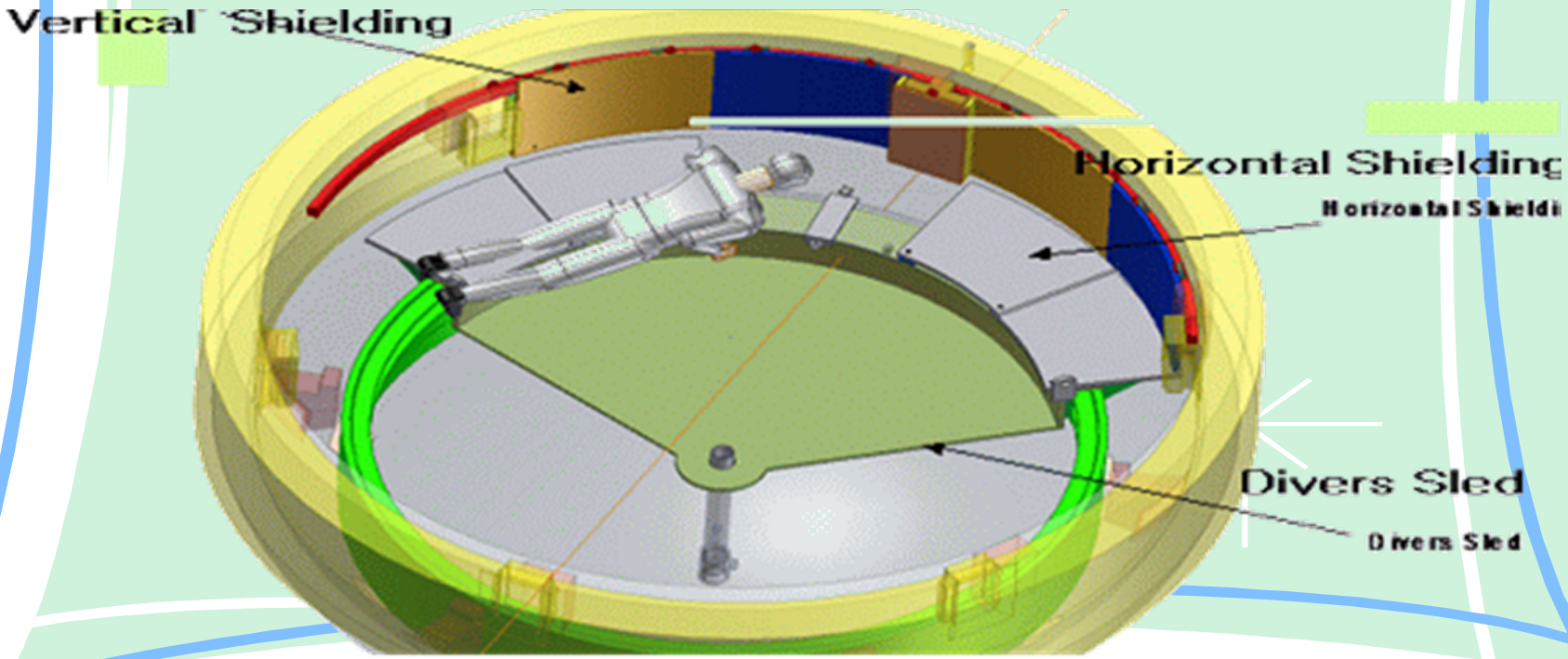
   b. Engineer and Technician : six people in number

   c. QA and QC : two people in number

   d. Diver : eleven people in number

Repair Schedule of Bottom Header Defected

1. It was removed internal RX structure from the elevation of 115 ft to the another Location
2. It was maintained water temperature of RCS under 90 ° F
3. It was maintained the elevation of water to the 123 ft
4. The tungesten of shielding was established to be decreased the level of high radiation in the surrounding of RX bottom defected.

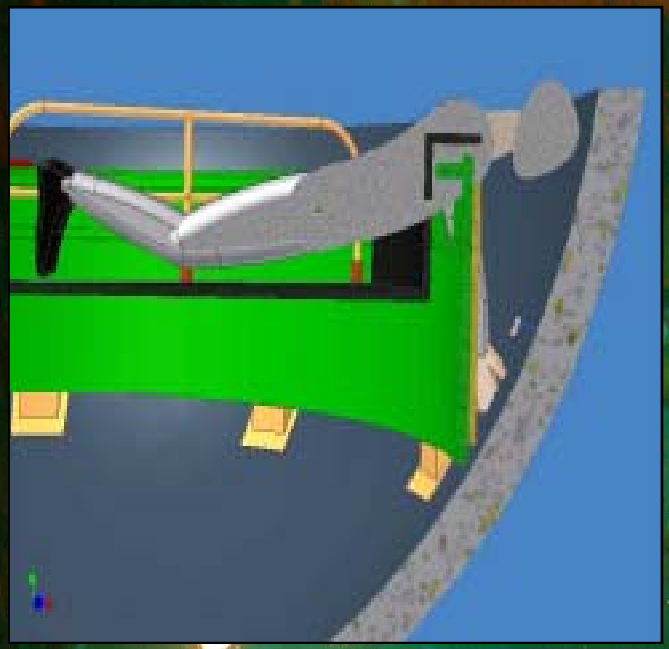


Status of Diver Shield Sled Establishment

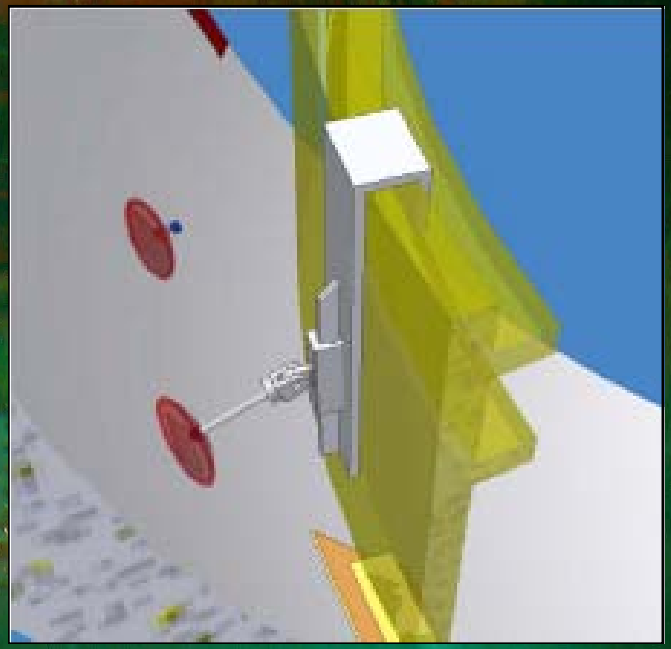
Diver Sled

Ground Plan of Job Process

Status of Diver Shield Sled Establishment

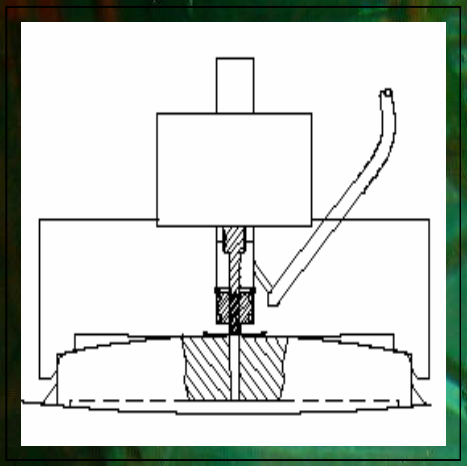


Side view of job process

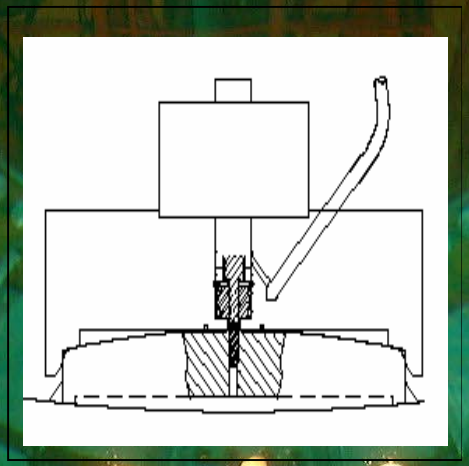


Establishment of Seal Plate

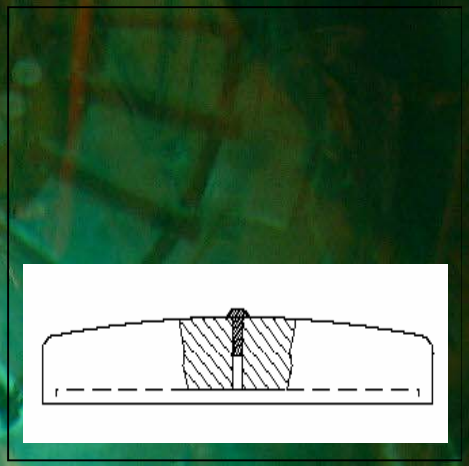
Procedure of Seal Plate Set Up



【Pic.1】Leak Test



【Pic.2】set up sealing pin



【Pic.3】job termination

The status of taking on a Diving suit

Assessment of shielding

The Shielding Material for diver sled and shielding was made of tungsten metal taking into consideration various features such as the density of shielding material, strength, the thickness and effects

1) Materials : Density 10 with tungsten metal
2) Shielding Thickness : over 14cm(it maintains below 1.0 mSv/hr after shielding)
3) Shielding Range : 120˚~360˚

Total Estimated Collective Dose

1. Precondition of Calculation

a. The Estimated collective Dose is evaluated in two aspects both without shielding material and with shielding material, the upper core stabilizing lug within a radius of 0° angle as Known the maximum radiation dose with 1,902 mSv/hr

b. The Estimated working time for Diver : 11 man-hr the total time

c. The Estimated working time for Assistant worker : 448man-hr

<7day × 8man × 8hr>

d. The Estimated collective dose in Both the aspect of withouting Diver shielding sled and the aspect of with Diver shielding

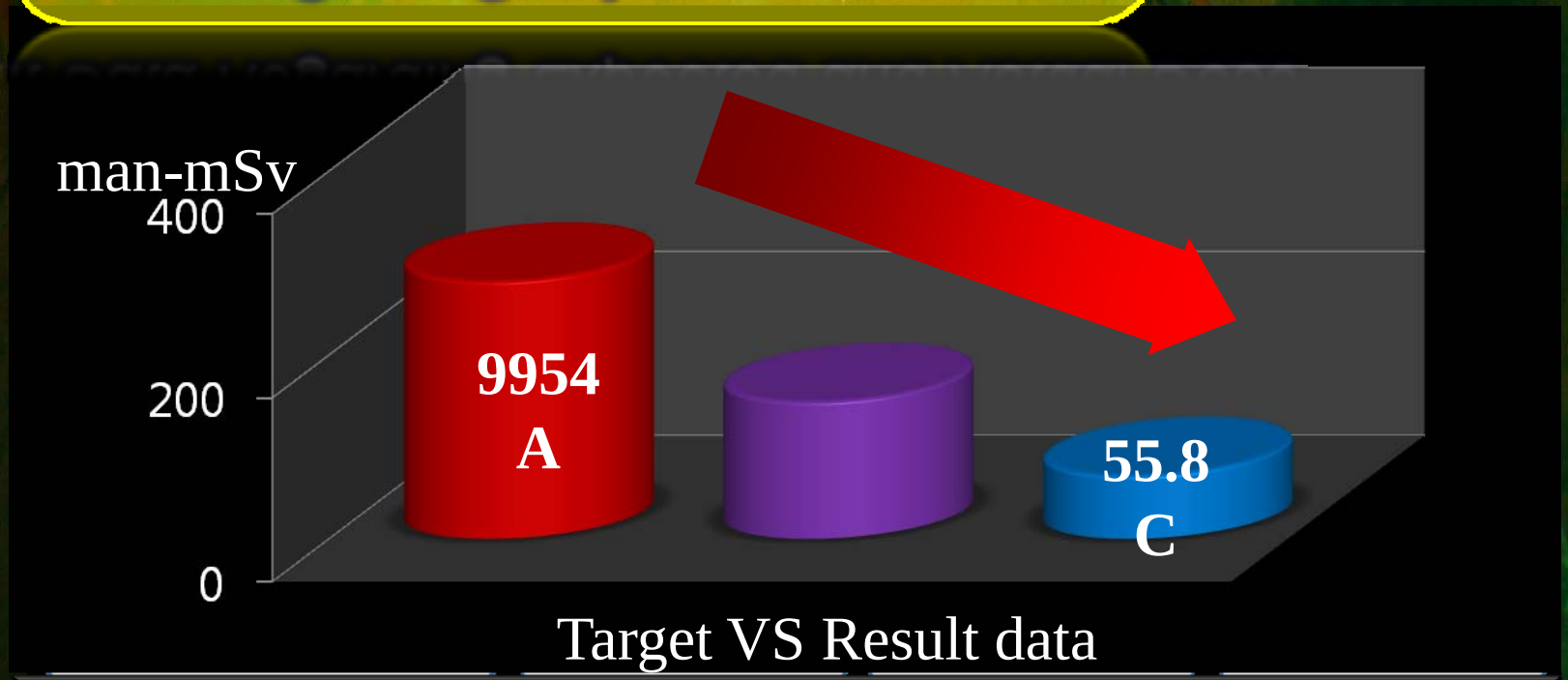
Total Estimated Collective Dose

2. Estimated Collective Dose(55.8 man-mSv)

Section	Withouting diver shielding sled			With diver shielding sled		
	Dose rate maximum (mSv/hr)	Estimated time (man-hr)	Total collective dose (man-mSv)	Dose rate maximum (mSv/hr)	Estimated time (man-hr)	Total collective dose (man-mSv)
Main worker	주1) 900.9	11	**9,909.9**	주3) 1.0	11	**11**
Aux worker	주2) 0.1	448	**44.8**	주2) 0.1	448	**44.8**
Total collective dose	-		**9,954.7**	-		**55.8**

RESULT (1)

Result Data Regarding Expected and Actual Dose



A : Target dose of maintenance, repair without shielding.
C : Target dose of maintenance, repair with shielding.

THANK YOU