"Hot Topic Report of Bottom Header Defected, YGN 5 in 2003"

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The inspection during the refuel outage of the Young Gwang Nuclear Power Plant unit 5 Unit found that 3 out of 8 thermal sleeves were dislocated from the safety injection nozzles on the bottom header of the reactor vessel.

One of the thermal sleeves was located on the bottom of the reactor vessel; as a result, the bottom header surface of the reactor vessel was affected, damaging two spots on the bottom surface.

For reference purposes to other plants, two issues are reported regarding the damage to the reactor vessel bottom header. First, the result of the evaluation of the dose measured around the damaged bottom header, carried out by the Radiation Safety Department to prepare for future repair, is presented. Second, the repair plan for restoring the damaged bottom header is presented. The repair was planned to be carried out by GENE (General Electric Nuclear Energy Company) and UCC (Underwater Construction Corporation). The repair plan has been delayed for several reasons on the plant side.

Dose evaluation

Table 1 shows the evaluation results of the maximum dose rates at work locations around the bottom header of the reactor vessel. The maximum dose rate at the work area has exceeded 1 mSv/hr; in order to limit it to below 1 mSv/hr, a diver sled and shielding were installed. With density, strength, and other factors into account, the material for the diver sled and shielding was decided to be tungsten. The evaluation results for shielding are shown in Table 2. The results show that the dose rate at the work area can be kept below 1 mSv/hr by installing tungsten shielding.

Table 1 Evaluation of maximum dose rate at work areas

6. Maximum Radiation Dose Rate for job area

Monitoring area	Monitoring location	Maximum Dose Rate (mSv/hr)	Remarks
Within a radius of 300° ~60° at bottom header damaged	0° Surface point the upper stabilizing lug	1,902	Position of Defect
Inside wall and height at Rx vessel	7.8m height point from the inside bottom header	275	Position of Defect
Rx Cavity	Aside stair at CSB	1.80	Route for job's worker

[Table 4)] Survey point and Maximum Radiation dose rate for job area

Table 2 Evaluation result of shielding effect

Section	Before shielding [mSv/hr]	After shielding [mSv/hr]	Thickness of shielding [cm]	Reduction rates
Water	1,902	900.9	30	1/2.1
Tungsten		0.9197	14	1/2,068
Iron		1.09	22	1/1,745

[Table 7)] Radiation Dose rate Between before and after shielding

Table 3 shows the results of the estimation of collective doses. By applying the tungsten diver sled and shielding, the total collective dose was reduced to 55.8 man-mSv.

Table 3 The result of the estimation of collective dose

Section	Situation of withouting diver shielding sled			Situation of 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	주 1) 900.9	11	9,909.9	주 3) 1.0	11	11
Aux worker	주 2) 0.1	448	44.8	주 2) 0.1	448	44.8
Total collective dose	-		9,954.7	-		55.8

[Table 8)] The comparison of estimated collective dose following on whether shielding or with shielding

Repair schedules for the damages of the bottom header of the reactor vessel

1. Repair service providers
   a. Management: GENE
   b. Underwater welding: UCC
2. Maintenance
   The repair work on the damaged bottom header of the reactor vessel is to be carried out first by performing underwater seal welding and installing a seal plate with an NDE method, followed by forming of the ring shape.
3. Total number of workers (GENE/UCC): 22
   a. Project manager and work process managers: 3
   b. Engineers and technicians: 6
   c. QA and QC: 2
   d. Divers: 11