

“Dose Rate Reduction Methods at Shimane Nuclear Power Station”

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In Shimane Unit 1, hydrogen injection has been carried out since the 21<sup>st</sup> cycle as a measure of SCC control. However, hydrogen injection has been known to increase the amount of Co-60 incorporated into oxide film through the increase in hydrogen concentration in feed water. In Shimane Unit 1, the dose rate at the PLR piping increased continuously after the commencement of hydrogen injection (see the figure below), and reached a total collective dose of 3 man-Sv at the 27<sup>th</sup> periodic inspection, the highest level measured in BWR periodic inspections in Japan in recent years.

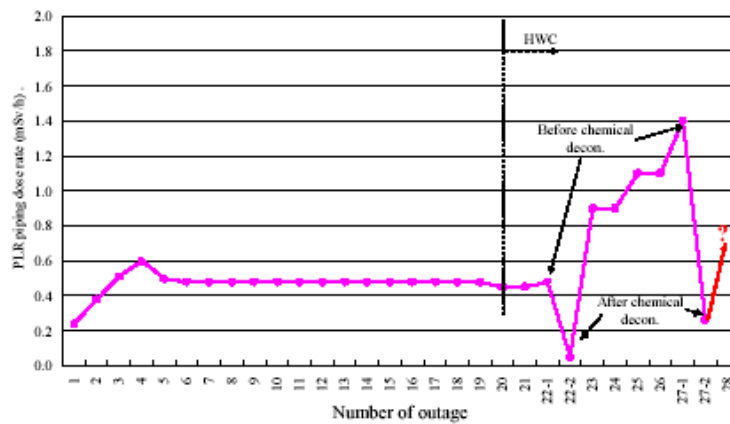


Figure 2 PLR dose rate trend at Unit 1

Exposure reduction measures were then reviewed. After the completion of chemical decontamination at the 27<sup>th</sup> periodic inspection, a preliminary oxidation operation was carried out for 90 days under Hi-F coated, NWC conditions at the beginning of the 28<sup>th</sup> cycle. Hi-F coating is a method in which an oxide film is forced to form on the substrate surface. As a consequence of exposure reduction measures such as those above, the dose rate for the PLR piping system of Shimane Unit 1 was lowered significantly, to about 0.5 mSv/hr (see the figure below), much lower than the 27<sup>th</sup> periodic inspection.

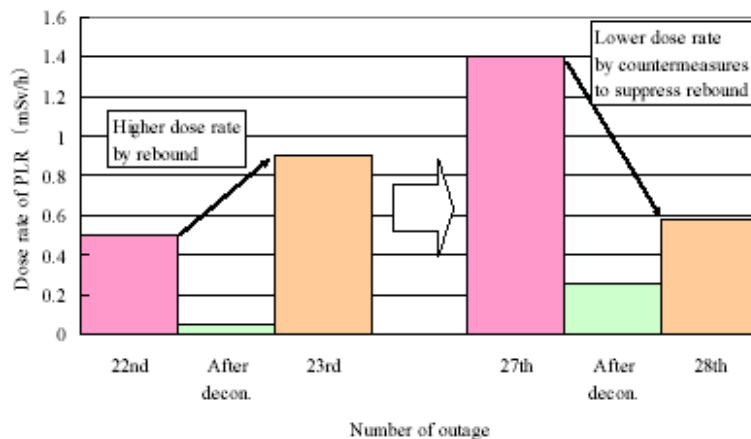


Figure 5 Dose rate change of PLR piping after the 27<sup>th</sup> outage

It is suspected that the protection film formed by Hi-F coating and NWC preliminary oxidation operation inhibited deposition of Co-60 onto oxide film, which reduced the dose rate.

Further, installations of additional exposure reduction measures, such as online monitoring, zinc injection and temporary shielding, will be reviewed.

#### (1) Online monitoring

If the dose rate for the PLR piping system can be measured during operation, it is useful for controlling hydrogen injection rate, making decisions on whether chemical decontamination is necessary at the time of outage planning, and so on. Therefore Chugoku Electric Power Company decided to develop an online monitoring system. We have installed an experiment device, as below, and basic data gathering will be carried out for designing during the 29<sup>th</sup> cycle.

- Experimental equipments to gather basic data such as energy distribution of gamma ray and atmospheric dose rate in the PCV.

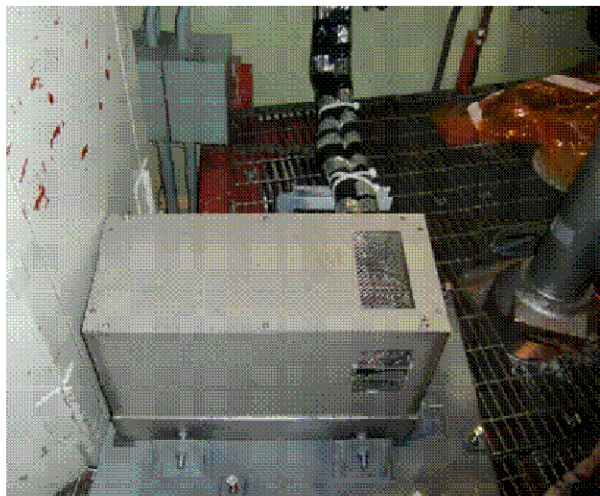


Figure 8 Appearance of experimental equipments

#### (2) Zinc injection

Zinc injection is an ideal dose rate reduction measure for Chugoku Electric Power Company, which prefers to continue hydrogen injection. Research on zinc injection cases around the world, and an effectiveness verification experiment for Shimane Unit 1, to which zinc injection was applied, are planned for this year.