

# Establishment of DF(Decontamination Factor) Target for Kori-1 Full System Chemical Decontamination

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## 1. Introduction

Full system decontamination (FSD) will be conducted in preparation for decommissioning and dismantling Kori-1. This paper deals with DF (Decontamination Factor) target for Kori-1 FSD campaign based on the recent contact dose rate measurements.

## 2. Methodology

### 2.1 Radiological Survey

Contact dose rates at 21 points of Kori-1 were measured by Teletector (Model No. 6112) on August 3, 2017. In addition to the contact dose rate measurement, relative radiological contributions of radionuclides to dose rates were assessed by gamma spectrometry detector at the same time.

### 2.2 Prediction of Future Dose Rate Trends

Dose rate trends of Kori-1 were predicted by the equation below. In this prediction, no additional source term for radionuclides was assumed because Kori-1 is now in the permanent shutdown phase.

$$D_i(t) = D_0 \left( \sum \frac{C_n}{100} e^{-\lambda_n t} \right) \quad (1)$$

Where,  $D_i(t)$  : Predicted Dose Rate (mSv/hr)  
 $D_0$  : Measured Dose Rate (mSv/hr)  
 $C_N$  : % Contribution to Dose Rate  
of Radionuclide N  
 $\lambda_n$  : Decay Constant ( $\text{day}^{-1}$ )  
 $t$  : Time (day)

## 3. Result

The measured contact dose rates are presented in Table 1. During the measurement, all the systems except pressurizer spray line were filled with water. At the same time with measurement of contact dose rates, radiological contributions to measured dose rates at each location were also assessed. In this assessment, as expected, the Co-60 was found to be the main contributor to measured dose rates at the time of measurement.

Based on the relative contribution to dose rate of main radionuclides, future dose rates were projected assuming that Kori-1 FSD campaign will be performed in the first quarter of 2019. The predicted dose rates are also given in the Table 1 (The target date to prediction is set to January 1, 2019)

Table 1. Measured and Predicted Dose Rate

Survey Point	Dose Rate (uSv/hr)		
	Measured	Predicted	
Loop 1	HL1	800	454
	CL1	700	397
	C2	1,000	542
	C5	250	158
	S1	120	68
	S2	70	40
Loop 2	HL1	700	397
	CL1	1,000	567
	C2	600	343
	C5	200	126
	S1	60	34
	S2	50	28
PZR	Surge	500	333
	Spray	800	481
CVCS	Letdown	900	379
	Charging	30	12
	Orifice	700	421
RHR	Piping	150	75
	Piping	100	50

The goal of FSD is normally defined by establishing a DF target. In order to comply with Nuclear Safety Act Amendments of Korea, radiation exposure of plant workers should be limited to 100 mSv during 5 years. So FSD target for Kori-1 campaign is established to restrict the radiation exposure to allowable limits in a conservative way.

For this purpose, we assume that annual working hour of plant workers be 2,080 hours.

The overall DF target is set up by just averaging DF values at each surveyed point to comply with limits specified in the Nuclear Safety Act of Korea based on the projected dose rate values (namely, 9.6 uSv/hr). From this calculation, we establish the target of DF for Kori-1 FSD campaign to be 30 on the whole.

#### **4. Conclusion**

The following conclusions can be made from this study.

- 1) Contribution of Co-60 to measured dose rate is verified to be dominant at this time of Kori-1.
- 2) Large variations in the surface isotopic composition were observed from different points in Kori-1.
- 3) The DF target of 30 was reasonably established for Kori-1 FSD campaign based on the projected dose rates.