

PHYSICAL AND CHEMICAL PROPERTIES AND COMPOSITIONS OF LIQUID EFFLUENTS OF
A NUCLEAR POWER REACTOR

T.Hashimoto^{*1}, M.Nishikawa^{*1}, T.Sato^{*1}, K.Sono^{*2}, S.Masuyama^{*2}, H.Kuratani^{*2}
and M.Yoshioka^{*3}

^{*1}The Japan Atomic Power Co. ^{*2}Japan NUS Co.,Ltd.

^{*3}Fukui Prefectural Institute of Public Health

Behaviors of the released radioactive materials from a nuclear power plant to the marine environment depend largely on their physical and chemical properties. It is therefore important to grasp the compositions of the liquid effluents. From this point of view, some kinds of drainwater of a BWR plant were sampled(Figure 1). These samples are the laundry drain water at charcoal bed inlet and outlet, and the floor drain water. Suspended solids were separated from these samples physically with the step filtration method and ions chemically with the ion exchange resin. Radioactivity of Co-60, Mn-54 and Cs-137 was measured with γ -spectrometer. Suspended solids of the laundry drain samples were also analysed with the instrumental methods(differential thermal analysis, X-ray diffraction analysis and X-ray fluorescence analysis).

It was found that the majority of radionuclides Co-60 and Mn-54, in laundry drain water, were suspended in the form of solid, while that of radionuclide Cs-137 solved in the liquid. The radioactivity on the particles of about $10\mu\text{m}$ -size was high, and the particles were identified as the organic matter, the mineral and so on. In the liquid phase, radionuclide Cs-137 was found as mineral compound(Figure 2 and Figure 3).

Decontamination factor and decontamination characteristics for the laundry drain water were also investigated in order to verify the performance of the filtering system. It was found that the decontamination factor of the charcoal filter was about from 3 to 10, and radionuclides Co-60 and Mn-54 in the liquid was removed to some extent while radionuclide Cs-137 was removed little(Table 1).

In the samples of floor drain water, radionuclides Co-60 and Mn-54 were found both in the form of the suspended solid of about $10\mu\text{m}$ -size and in the form of the mineral compound in the liquid phase(Figure 4).

A chemical analysis method was also established in order to measure the extremely low concentration of radionuclide Co-60 in the sea water(1000 ℓ). The radioactivity of 0.2~0.7pCi/1000 ℓ could be detected with this method at the frontal sea area of the small bay where the liquid effluents of BWR plant are released.

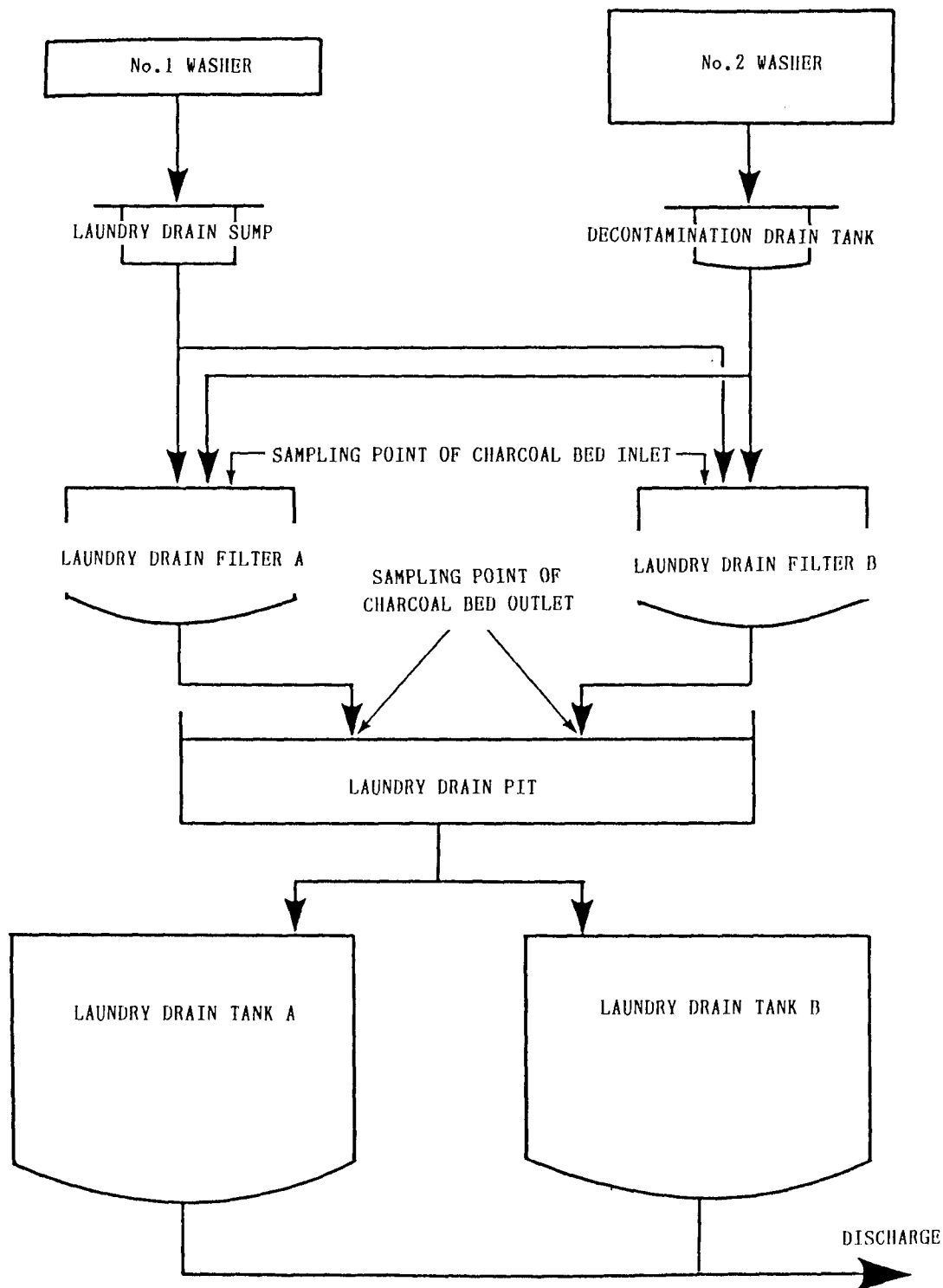


Figure 1 Sampling points of laundry drain water

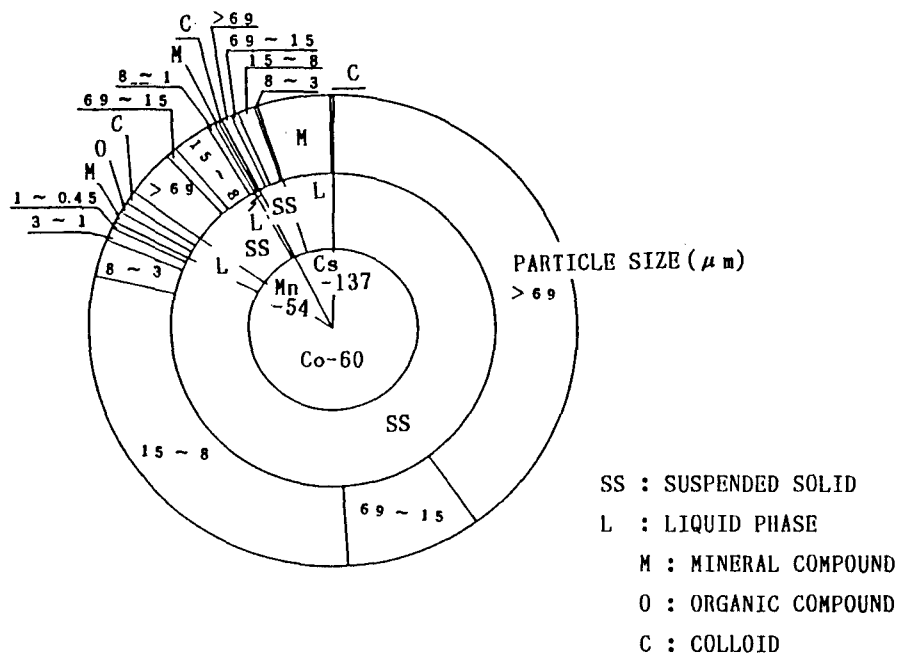


Figure 2 Composition of laundry drain water charcoal bed inlet

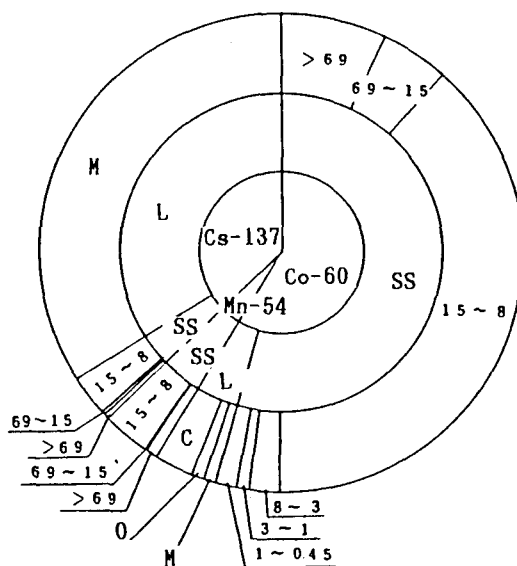


Figure 3 Composition of laundry drain water charcoal bed outlet

Table 1 Radioactive concentration and decontamination factor
of laundry drain charcoal bed

		Co-60 (pCi/l)	Mn-54 (pCi/l)	Cs-137 (pCi/l)	Total (pCi/l)
Normal operation (typical data)	Charcoal bed inlet	1327.7	107.4	37.7	1472.8
	Charcoal bed outlet	105.4 (DF 1/13)	5.0 (DF 1/21)	30.8 (DF 1/10)	141.2 (DF 1/10)
Maintenance outage (averaged data over typical two weeks)	Charcoal bed inlet	445.1	42.8	68.2	556.1
	Charcoal bed outlet	138.3 (DF 1/3)	11.4 (DF 1/4)	58.7 (DF 1/3)	208.4 (DF 1/3)

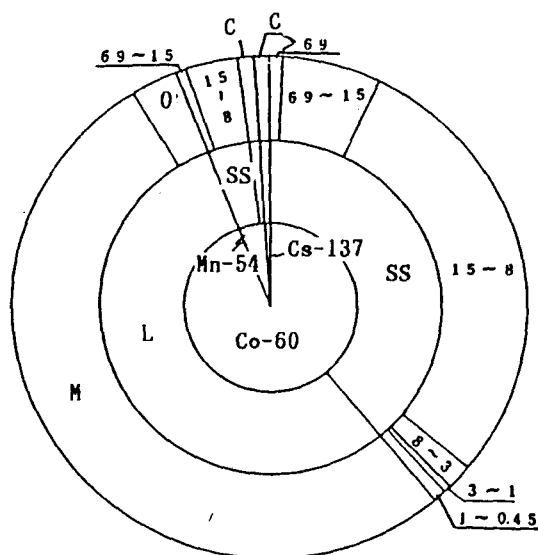


Figure 4 Composition of floor drain water