Modification of SGS System for Application to Various Sized Drums

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To dispose the radioactive waste drums, the waste form's integrity and the nuclides' inventories must be assured according to the national and site waste acceptance criteria. Because they might be would gravely affected the performance objectives of disposal site. Our national regulation for the waste inventory related to "Radioactive Waste Acceptance Criteria" requires that the activities of 13 nuclides and gross α must be measured and the 95 % of nuclides incorporated in the drum must be identified.

It is very difficult to measure the radioactivity with accuracy from the regulated waste drum(200L), and have a large error in the analysis results. In present, there are two system, SGS (Segmented Gamma Scanning System) and TGS (Tomographic Gamma Scanning System) for the analysis of radionuclides from the waste drums. In general, it is known that the accuracy of TGS is below 20 % and that of SGS is below 30 %. The accuracy of TGS is better than that of SGS. But it is sure that TGS has no economic benefit because of the high expensive, the difficult operation, limits in the measurement of a certain drum (high density, high level) and a long time of measurement. It is not important to know the distribution of activities in drum.

Therefore for the minimization of the measurement error in SGS, the competition against to the TGS, and for the application to the various drum (100 ~ 350L), we modified the existing SGS system such as the easy control of the distance between detector and drum so that it is possible to change the number of segments of drum by changing the aperture of collimator(horizontal and vertical) or by moving the detector(Fig. 1). And also we prepared the mass attenuation file similar to the real drum (chemical composition, ratio of waste and matrix).

First of all, we carried out the performance test with two model drums (200L drum of which density is 0.34 and 1.9 g/cm^3) with a low activity standard source. The results are presented in Table 1 and Fig. 2. The results measured in 10 segmented drum was better than that in 8 segmented drum, and their error were below 12%(in low density, d = 0.34), 9%(in high density, d = 1.9). In conclusion, we could find that our system have a performance like to the TGS except the distribution of activities in a drum and can be applicable to the various drums by changing the distance between detector and drum, so can be applied to the drums which TGS system does not analyze drum (for example, high density, high activities and large volume).

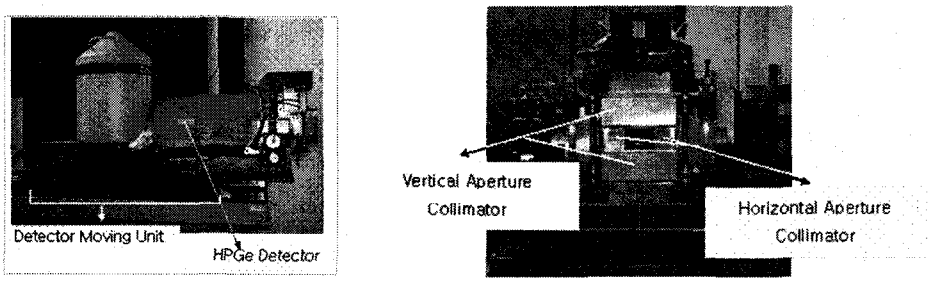

Fig. 1. SGS system modified in detector mover and collimator

Table 1. Analysis results measured in a short distance (10 segments)

Drum Type	Meas. Time(sec)	Co-60	Cs-137	
Cork D=0.34	60	52.311 ± 5.378	89.916 ± 16.098	Standard source Co-60, 47.87 μCi Cs-137, 101.16 μCi
	120	52.140 ± 5.136	91.318 ± 15.860	
	180	53.114 ± 5.240	94.145 ± 16.520	
	240	53.676 ± 5.269	93.198 ± 16.380	
	300	52.117 ± 5.121	91.947 ± 16.211	
Sand D=1.9	90	49.827 ± 27.697	103.840 ± 108.690	
	120	50.295 ± 26.985	98.954 ± 99.930	
	180	50.631 ± 27.028	93.840 ± 94.228	
	240	53.230 ± 28.022	101.550 ± 100.610	
	300	49.521 ± 27.776	95.876 ± 94.836	

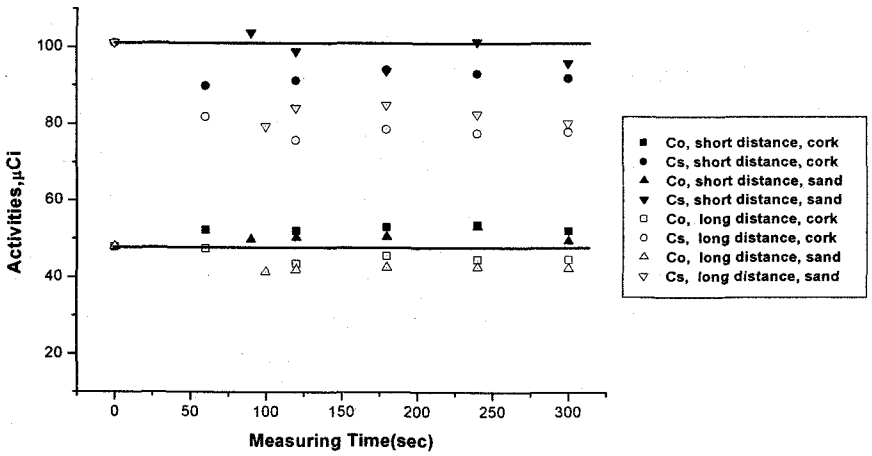

Fig. 2. Activities of Co-60, Cs-137 measured in 8 and 10 segmented drums(200L)