RADIOLOGICAL ASSESSMENT AND MANAGEMENT OF RADIOACTIVE SPILL IN A LIQUID WASTE TREATMENT FACILITY-CASE STUDY

H.A. AMER, S. SHAWKY, N. IBRAHIEM
National Center for Nuclear Safety and Radiation Control, AEA, Cairo, Egypt

The radiological assessment and management of radioactive spill from liquid waste treatment facility is presented. The incident contaminated the area surrounding the treatment facility with various radionuclides, which were dispersed into the soil. A method based on the European basic safety standards was used to contain the risks associated with the contaminated site.

The introduced case study proceeded up to the stage of simplified risk study, since the site is small and it was relatively easy to remove and store the contaminated soil. According to the obtained results, the removal of the upper 30-cm would be considered as appropriate remedying action to resume background level. One of the most important basic concepts of radiation protection in nuclear facilities is the continuity of monitoring radiological release to the environment. It is known that from nuclear facilities only very small amounts of radioactivity are discharged with the liquid effluents and the exhaust air into the environment. Recent studies screening the natural and artificial radionulcide in soil samples from the investigated area revealed normal background concentrations with no anomalies [1].

The incidental release of radioactive liquid waste from a small-scale waste treatment facility led to finite contamination with some radionuclides, which were spread over the surrounding of the treatment unit. *Thus it was necessary to provide not only site management principles, but also precise descriptions of each assessment stage.* Since the adopted guidelines are intended to deal with the various situations that might be encountered in practice, the approach involves several stages [2,3]. In another cases, the site might be contaminated indeed but in a small scale and its contamination profile is relatively easy to grasp. In such cases, a simplified risk study can be carried out and a satisfactory remedying strategy or use advocated. Aliquots of about 50g of each sample were transferred into Aluminium containers and sealed with the same shape and geometry as the calibration source. A high-resolution gamma spectrometer based on hyper pure germanium detector (HPGe) from EG&G Ortec was used for the gamma analysis. The HPGe crystal has diameter of 64.5 mm and 69.9-mm length, relative efficiency of 50 %, peak to Compton ratio 62, FWHM of 1.9 keV at the 1.33 MeV ^{60}Co transition and 753 eV at the 122 keV ^{57}Co transition. The efficiency calibration for the system has been explained in a recent publication [4]. In addition, a mixed gamma source solution in the same type and configuration was used to determine the absolute efficiency curve.

The decision of the decision-makers regarding which remedying action should be carried out based on the preliminary results obtained from the gamma measurements.

The distribution of activity concentrations in the investigated hotspots showed basically about 80 % on the surface soil layer, 25 % within the next 10 cm and less than 1 % within the 10 – 25 cm. Fig. 1 (a) shows the variation factor and the count rate of fraction loading at different depth, and (b) illustrates the total activity distribution of ^{137}Cs, ^{134}Cs and ^{60}Co (Bq kg^{-1} DW) as well as the mean, minimum, and maximum value of the selected nuclides. Fig. 1 (b) shows the ranges and mean ± SD (given between brackets) for the concentration ratio of ^{137}Cs, ^{134}Cs and ^{60}Co with respect to the total activity were 33 – 88 % (62 ± 22), 0.7 – 1.5 % (1.1 ± 0.3) and 1.1 – 2.2 % (1.7 ± 0.54) respectively. Soil profiles showed greater activity concentrations in the surface layer, which could be attributed to the fact that this discharge is relatively new. However, considerable concentrations of various radionuclides could be determined in deeper layers. According to those finding, the removal of the upper 30-cm of the surface soil would indeed reduce the activity concentration to practically resume the normal background activity background.

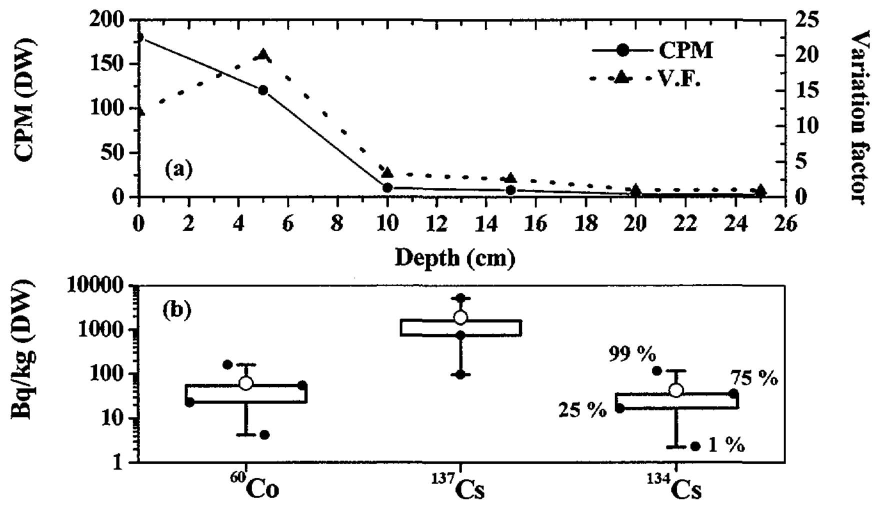

Fig. 1: (a) The variation factor and the count rate of fraction loading at different depth (b) Total activity distribution and the measure of deviation tendency of ^{137}Cs, ^{134}Cs and ^{60}Co (Bq kg^{-1} DW) in the investigated samples

Recommendations

Although the undertaken remedying actions were quite successful, further investigations should be carried out to prove whether those remedying actions achieved the desired goals. The possibility of contaminant transport through weathering and migration should be studied. Dose assessment and source term calculation should be planed.

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