Improvement of analysis accuracy of radiation monitoring using unmanned helicopter

*Youichi Yuuki[1], masamichi maeshima[1], Eiji Nakayama[1]

1. Oyo corporation

After the Fukushima Daiichi Nuclear Power Plant accident occurred in 2011, the air dose rate was measured using an unmanned helicopter in the high radiation area around the power station.
Measurement was carried out by measuring the counting rate of gamma rays with using an LaBr3 detector at an ground altitude of 100 m and a line interval of 80 m. Measured data was analyzed and converted into air dose rate at 1 m above the ground.
Since the counting rate of gamma rays decreases exponentially with altitude and proportional to 1 m height air dose rate, calibration measurement was performed to obtain altitude correction coefficient (air attenuation coefficient) and the conversion coefficient in the flat area where the change in the air dose rate was small,.
We analyzed the LaBr3 system by the gross count method after applying dead time correction of the detector. Furthermore, after subtracting the dose rate derived from the natural radionuclide, data with the different measurement date was corrected to the reference date (generally end date of measurement) using the attenuation correction formula. The analysis result was mapped by Kriging method using ArcGIS.
To confirm the validity of the measurement, ground measurement was carried out by a survey meter, and a comparison was made between the air dose rate obtained from an unmanned helicopter and the measured value on the ground.
Examination result shows the change in the count rate due to the season change and the divergence on ground measurement value according to the measuring point was observed. At the beginning of the accident, the air dose rate due to contamination was high and the physical decay rate of the radioactive material was not known but there was attenuation due to weathering and decontamination and counting rate should be calculated accurately in low dose area. For this reason, we considered analysis that take account of improved analysis parameters and consider effect from radiation source influenced by topography and flight altitude.
As a result of the examination, analysis parameter was improved by analyzing the air attenuation coefficient as a function of air density and using "mass attenuation coefficient" obtained by dividing the air attenuation coefficient by the air density as a constant. We conducted inverse analysis to improve the influence from radiation source by topography and flight altitude and confirmed that it can be analyzed with higher resolution.

Keywords: gamma-ray spectrometry, Unmanned Helicopter, Mass attenuation coefficient, 3D inversion

