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Imaging of radioactive material and its host particle from the nuclear power plant accident in Japan by using imaging plate and electron microscopy

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The Fukushima Daiichi Nuclear Power Plant accident in Japan on March, 2012, dispersed radioactive materials. In the Meteorological Research Institute, where locates 170 km south west from the power plant, we collected two types of filter aerosol samples and wet and dry deposition particles before and after the accident. Using these samples, we analyzed 1) radioactivity using an imaging plate (IP), which visualizes the radioactivity of samples in a two-dimensional plane with space resolution $\sim$0.05 mm and 2) shape and compositions of particles that host radioactive materials using a scanning electron microscope (SEM) with energy-dispersive X-ray spectrometer (EDS). From the samples collected on March 15 and 21, we found radioactive spots on the filter samples using the IP, suggesting that radioactive materials, presumably Cs, were carried from the power plant. Radioactivity was also detected over the aggregates of dust particles in wet and dry deposition samples collected from March 2011. We did not find any detectable radioactive materials after the April when using the IP. We further investigated the radioactive spots using the SEM to identify the host particles of the radioactive materials and to detect radioactive materials from the EDS analysis. From the SEM analysis, we found that the particles on the filters include sulfate, mineral dust, and metals, but there were no particular particles or materials in the radioactive spots comparing to those in other area. The result suggests that the radioactive materials are hosted on the surface of other particles or inside them. We, so far, did not obtain any evidences that the radioactive materials are particulate with larger than 0.1 micro meter. Further analysis will need to identify the source of radioactive spots from individual particles using a manipulator as well as SEM and IP. Such studies will reveal where the radioactive materials exist in the environment, how they resuspend in the air, and how they could bring the health impact.