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ASSESSMENT OF RADIATION DOSE TO WORKERS BY POTASSIUM COMPOUND IN NORM INDUSTRIES IN KOREA

Potassium compounds are used in various industries, such as raw materials in the production of chemical products or as catalysts. A radioactive isotope of potassium, K-40, has a natural abundance of 0.012% in potassium, and a high-purity potassium compound may have radioactive concentration of K-40 exceeding 10 Bq/g. Therefore, it is necessary to assess the exposure level of workers handling high-purity potassium compounds in large quantities. In this study, we assessed the annual radiation dose to workers in workplaces handling potassium compounds in Korea.

In Korea, annual survey is conducted for safety management of NORM facilities. In NORM field survey, a total of 29 facilities handling potassium compounds were assessed for radiation dose to workers. The 10 types of potassium compounds such as KCl, K₂CO₃, KOH, and KNO₃ were assessed, with radioactivity concentration of 6.3 - 21.7 Bq/g, and annual handling amount of 65 - 4,000,000 MBq. Radiation dose to workers resulting from external exposure was assessed using the directly measured ambient dose equivalent rates and hypothetical exposure scenarios. Radiation dose to workers due to inhalation of particulates was assessed based on ICRP-66 Human Respiratory Tract Model and actual measurement data of airborne particulates.

Annual radiation dose to workers was assessed as an average of 0.11 mSv/yr and a maximum of 0.54 mSv/yr in the field of potassium nitrate production. Out of the effective dose of all workers, Radiation dose resulting from external exposure accounted for more than 99%, and Radiation dose due to inhalation of particulates was not significant at several nSv/yr. And in the process where a large amount of potassium compounds are handled, such as fertilizer manufacturing, heavy equipment such as shovel loaders or tank lorries are mainly used or operated as a closed system. It was found that the radiation dose to workers did not increase significantly because the workers were separated from the potassium compound by a certain distance or the handling time was short. Therefore the effective dose to workers due to potassium compounds is expected to be almost less than 1 mSv/yr in Korea. The range of radiation dose to workers is similar to the K-40 exposure level due to potassium homeostasis in the human body, and is lower than the level for exemption of bulk material containing radionuclides of natural origin suggested in the IAEA General Safety Guide.

In this study, we assessed the radiation dose to workers handling potassium compounds in Korea. Radiation safety management for workers handling potassium compounds needs to focus on external exposure. In addition, it needs to consider a graded approach from other NORM industries in consideration of the level of exposure. Based on the results, it will contribute to the optimization of radiation protection in NORM industry in Korea.

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