The Estimation of Environmental Radiation from the TENORM of the Industry Concentrated Area

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1. Introduction

Human being can be exposed continuously to low level radiation from raw materials in daily supplies including TENORM (Technologically Enhanced Naturally Occurring Radioactive Materials). Therefore, management of natural radioactive materials including NORM and TENORM is needed and actually Act on Safety Control of Radioactive Rays around Living Environment is in force since 2012. This study is plan for assessing radiation level in the industry concentrated area which is predicted to treat various natural radioactive source materials. Also, confirmation on the radiation safety is discussed by comparing the radiation of industrial area with that of other areas and analyzing it.

2. Plan

How to measure the radiation including TENORM and where to measure it is described.

2.1. Classification of the measurement place

In Ulsan Metropolitan City, huge petrochemical complex and heavy industry areas where the frequent use of natural radioactive materials is expected are placed. Also, Kori nuclear power plant to the south and Wolsung nuclear power plant to the north are in operation, which are close to the Ulsan area. Furthermore Shinkori unit #3 is scheduled to commercially operate in Ulsan area. Therefore, for the measurement of radiation, Ulsan area is divided into four distinguished regions including residential area, business area, industrial area, medical area as seen in Fig. 1. [1]

In industrial area, Onsan industrial complex is planned to measure which is discussed by rapidly increase of radiation level recently. In medical area, Ulsan University Hospital which uses radionuclide for healing purposes will be detected. In business area, apartment Store which causes movement of population is selected. In residential area, Myungji elementary school which is placed outside downtown and lived many children who are sensitive about radiation exposure is determined.

2.2. Measurement of radiation level

Radiation level is measured by using portable gamma dose rate detector, Inspector 1000, which can analyze the radionuclide from the spectrum of the measured radiation as represented in Fig. 2 (a). Fig. 2 (b) shows the measured results of the radiation dose rate and counting rates displayed at the screen [2]. Also, the kinds of the measured radionuclide are indicated in Fig. 2 (b). Actually, the radiation is measured in the air of the measurement place and by scanning the surface of the soil of the measured point. The measurement time at the fixed point is more than one minute for the nuclide recognition.

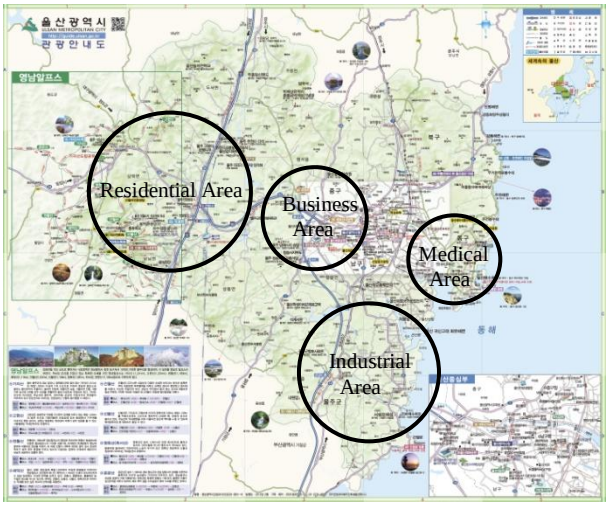

Fig. 1. Classification of Ulsan area by residential area, business area, industrial area and medical area

(a)

(b)

Fig. 2. (a) Portable gamma dose rate detector (Canberra, Model: Inspector 1000) and (b) the dose rate and spectrum analysis

2.3. Analysis of Radiation level

Each radiation level among the measurement places is compared. Whether the noteworthy differences exist among the comparative groups is confirmed. Then whether or not the radiation level changes by TENORM except NORM is determined and analyzed.

2.4. Safety estimation of radiation level around living environment

Environmental radiation by the TENORM from the industry concentrated area in Ulsan is estimated based on the natural radiation level in the whole country where that of Korea falls on the range of 50~300nSv/h, the limit of effective dose rate, 1 mSv/y, for the public, national environmental radiation alarm in Table 2 and exposure dose in daily life in Table 3.

Table 2. National environmental radiation alarm by Integrated Environmental Radiation Monitoring Network (IERNeT) [3]

Alarm Step	Set Point	Note
Normal	Average + 100 nSv/h (under 10 μR/h)	Normal fluctuation range by natural phenomenon
Caution	Average + 100 nSv/h (more than 10 μR/h)	Early detection of abnormal radiation, clarification of cause
Warning	1 μSv/h (more than 100 μR/h)	Recommend limit of food intake
Emergency	1 mSv/h (more than 100 mR/h)	Removal or evacuation

Table 3. Exposure dose in daily life by IERNeT [4]

		Classification	Range(mSv)
Exposure Source	Natural Radiation	Cosmic Radiation	0.3 ~ 1.0
		Radiation from soil and rocks	0.3 ~ 0.6
		Intake	0.2 ~ 0.8
		Breath(almost Radon)	0.2 ~ 10
	Artificial Radiation	Medical	0.1
		Nuclear Power Plant	0.0002
	Total		1.0 ~ 10

Conclusions

Ulsan Metropolitan City where huge petrochemical complex and heavy industry areas which is predicted to use natural radioactive materials are placed is worth measuring radiation level for accessing radiation level in the industry concentrated area. By carrying out the plan, safety of radiation environment concerned industrial facilities will be confirmed and public reliability on the environmental radiation can be established. It is thought that the analysis technique on the environmental radiation and radioactivity will be accumulated and that the technical base of the radioactivity analysis about TENORM industry will be constructed.

REFERENCES

[1] Ulsan sightseeing guide map, Ulsan Metropolitan City Hall.
[2]http://www.canberra.com/products/hp_radioprotection/inspector-1000.asp, Canberra.
[3] National environmental radiation alarm, Integrated Environmental Radiation Monitoring Network (IERNeT).
[4] Exposure dose in daily life, IERNeT.