Database on Naturally Occurring Radioactive Material

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Abstract

The International Commission on Radiological Protection (ICRP) 1990 Recommendations recommended that the occupational exposure of NORMs should be controlled. However, the current extent of the industrial use of NORMs is not clearly perceived, because the activity concentration in NORMs has a wide distribution from very low level, and NORMs are used for a variety of purposes. If these resources, containing radioactive nuclides in high concentration, are used, the workers handling them can be exposed to high levels of radiation without being aware of it. The activity concentration in many natural resources should be investigated to evaluate the radiation exposure of workers. In this study, we collected imported natural resources, and measured the activity concentrations in these resources using ICP-MS (inductively-coupled plasma mass spectrometry) and gamma ray spectrometry. Furthermore, we developed a database of activity concentration in NORMs using their results as well as investigation in literatures, and published the database on the web. (NORM database; http://www.nirs.go.jp/db/anzendb/NORMDB/ENG/index.php).

1. Introduction

Many types of NORM are used as industrial raw materials. However, activity concentration of NORMs has not yet been well identified because the activity concentration in NORMs varies over a wide range, starting at very low levels. Therefore, the activity concentration in NORMs should be investigated to evaluate the radiation exposure of workers. In this study, NORM samples were collected, and measured the activity concentrations in them using ICP-MS and gamma ray spectrometry. Furthermore, we developed a database of activity concentration in NORMs by reflecting the measured records as well as referring to literatures, and published a database on the web. This paper presents an overview of the database.

2. System of NORM database

This database mainly consists of two parts, which are “activity concentration” and “effective dose”.

2.1 Activity concentration

In the part of the “activity concentration”, the users can see more than 900 pieces of data of activity concentration of ^{238}U series, ^{232}Th series and ^{40}K in materials such as rocks and ores etc. using a search system. The classification of these materials was defined by referring to the harmonized system (HS) code defined by the World Customs Organization (WCO).

The outline of this search system is shown in Figure 1. The users can easily find out the needed data by selecting the name of materials and the countries of their origin (local origin).

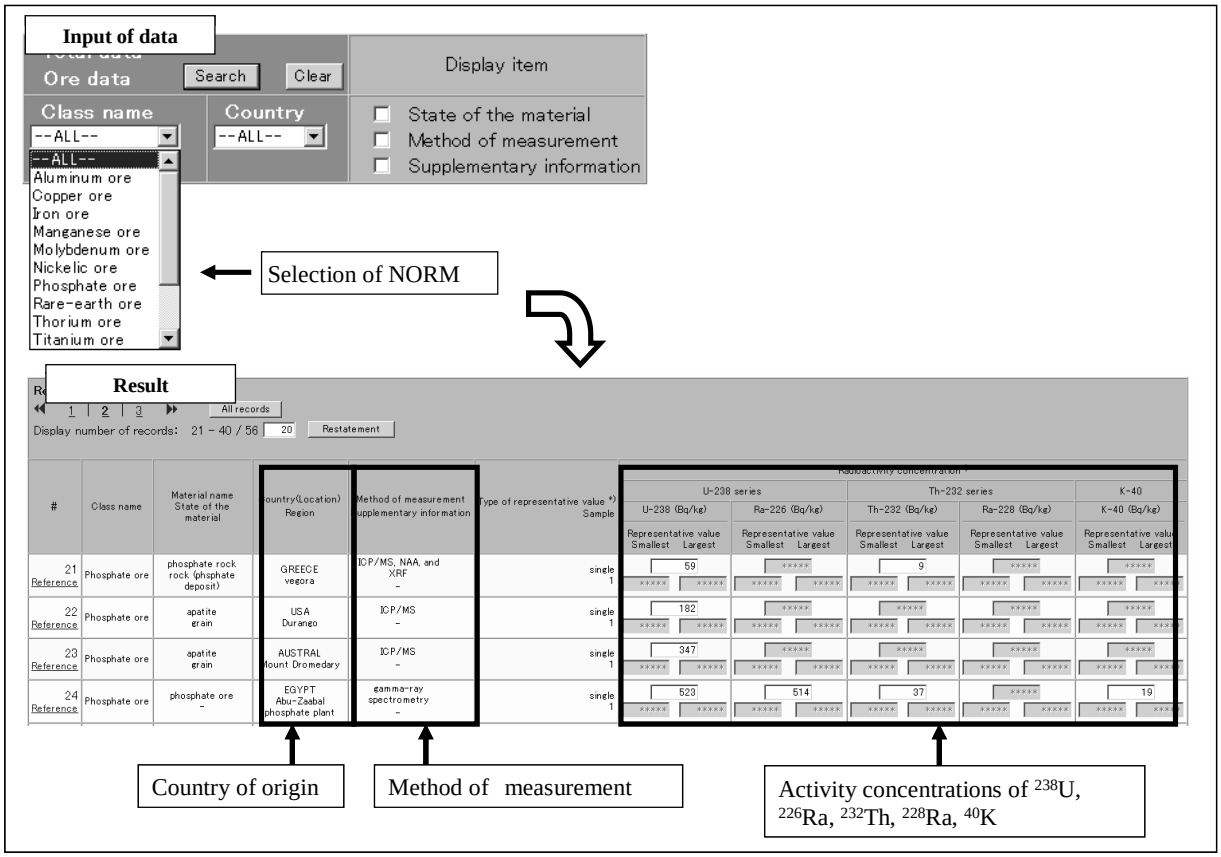

Figure 1 Outline of search system for activity concentration

2.2 Effective dose

In the part of the “effective dose”, the users can use a program for calculating effective dose to workers handling NORM. Models for dose assessments described in Radiation Protection 122 publication (RP 122) of the European Commission [1] are used for this program. The outline of this program is shown in Figure 2. The users can easily calculate the effective dose by inputting only four items (“Type of material”, “Name of material”, “Usage condition”, and “Annual work hours”). In the “Type of material”, the users can choose the type of material from variations such as “Natural resources”, and “Products”. In the “Name of material”, the users can choose the name of material from

variations such as “Zirconium ore”, “Granite”, “Coal”, “Coal ash”, “Gypsum”, etc. In the “Usage condition”, the users can choose the scenario for work from variations such as “transportation”, “indoor storage”, “indoor processing”, “outdoor storage”, “outdoor processing”, “road construction”, and “building construction”. In the “Annual work hours”, the users can input the work time.

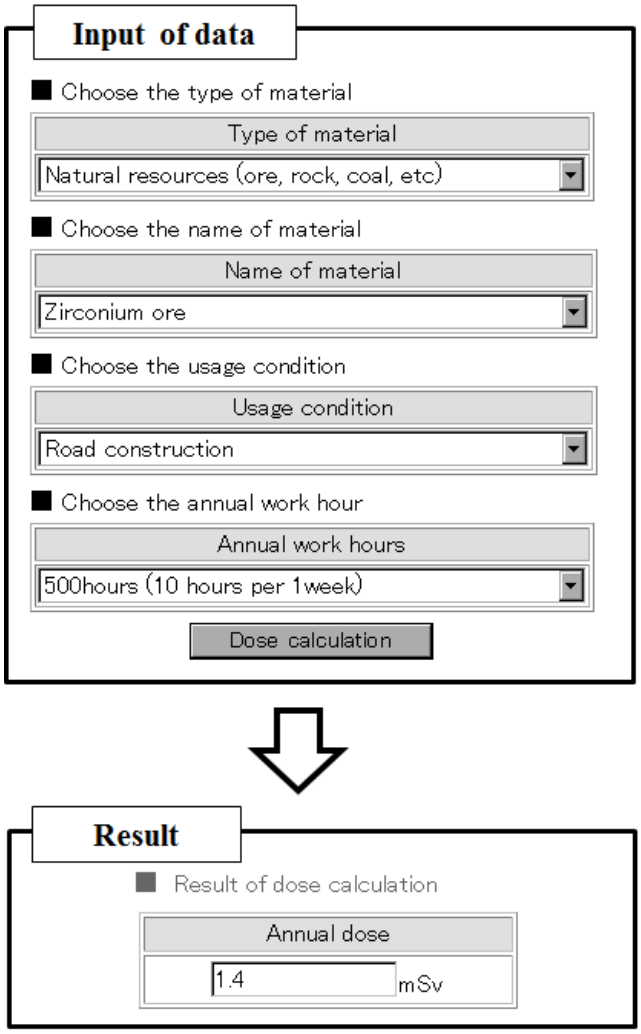

Figure 2 Outline of program for dose assessment

3. Some data of NORM database

Some data for ores and rocks, etc. in the database are shown in Table 1. These data regarding activity concentration are the mean values of activity concentration calculated by referring to the data of the database in January 2011.

Table1 Activity concentration of NORM

Materials	^{238}U series		^{232}Th series		^{40}K	
	Number[a]	Activity[b] (Bq/kg)	Number[a]	Activity[b] (Bq/kg)	Number[a]	Activity[b] (Bq/kg)
Ore						
Zr ore	45	4.7E+03	41	2.1E+03	33	1.2E+02
P ore	103	9.0E+02	83	1.5E+02	32	1.3E+02
Rock						
Granite	194	5.7E+01	183	9.5E+01	181	1.1E+03
Marble	67	2.4E+01	65	1.4E+01	65	1.1E+02
Gneiss	14	4.3E+01	11	5.6E+01	11	8.3E+02
Other						
phosphate fertilizer	74	5.9E+02	63	1.5E+02	21	4.9E+02
coal ash (fly ash, etc.)	25	2.9E+02	14	9.0E+01	14	3.4E+02

[a] Number: the numbers of data in the database

[b] Activity: the mean values of activity concentration calculated by referring to the database in January 2011

References

1 European commission, Practical use of the concepts of clearance and exemption, Radiation Protection 122, (2001)

2 National institute of radiological sciences, NORM Database (2011), http://www.nirs.go.jp/db/anzendb/NORMDB/ENG/index.php