

July 2010

Atomic Energy Society of Japan  
Health Physics & Environmental Science Division

Radiation Protection of Workers Who Handle Naturally Occurring Radioactive  
Materials (NORM)

Radioactive materials are generally considered as something specific to nuclear facilities. In fact, natural minerals in general industrial applications contain radioactive materials. This is because radioactive elements have existed in the earth's crust and the atmosphere since the formation of the earth. A large part of radioactive elements decayed and has lost their radioactivity, while some elements with longer half-life have retained their radioactivities until present day. The nature of radiation emitted from these naturally occurring radioactive materials do not differ from that emitted from artificial sources of radioactive material at all.

International Committee on Radiological Protection (ICRP), the international authority on radiation protection, has recommended necessity of regulatory control over occupational exposure of workers who handle naturally occurring radioactive materials (NORM). All minerals and raw materials contain to a more or less extent, radionuclides of natural origin. Exposure to these radionuclides is usually not considered of its specific health effects or safety significance. However, certain materials that give rise to significantly enhanced exposure with negative health impact has not been given due attention because the materials are natural origin.

In Japan, the management of naturally occurring radioactive materials (NORM) has been examined and compiled into a report by the General Administrative Group, Radiation Council<sup>1)</sup>. A thorough survey on natural radioactive materials handled in various industries and contained in consumer goods distributed on the market was conducted and following materials were listed up as materials with potential risk .

Monazite (health & fitness apparatus , paints, rare earths)

Phosphate minerals (phosphoric acid, phosphogypsum, phosphate fertilizer)

Titanium minerals (titanium dioxide, gypsum)

Bastnaesite (abrasives)

Zircon (refractory materials)

Samarium (magnets)

### Coal ash (fly ash)

Results of the survey showed that the radiation dose of workers in the manufacturing processes involving the above materials did not exceed 0.4 mSv annually; and members of public exposure to these materials contained in consumer goods did not exceed 0.1 mSv annually. In the report, the General Administrative Group recommended a management method classified into 8 categories in accordance with controllability and human factors. The proposal of the method for regulation of these materials is as follows; Items which is difficult to control, such as garden stones, rock samples for museums, rocks from construction sites, were excluded from the regulations. For residual materials deposited on the surface of inner wall of pipes and tanks at industrial plants, which are also difficult to control, radioactive decontamination measure was stipulated for the case that the dose level would exceed a criteria (which will be set within a range of 1 - 10 mSv/year) after a check-up. Raw materials for industrial application and radioactive residuals which radioactive concentration is enhanced in physical or chemical process of the plant must be controlled so that the annual dose to workers shall not exceed 1 mSv. Likewise with regulation of artificial sources of radiation, natural radioactive materials contained in consumer goods may not exceed 10  $\mu$ Sv per year (1 microsievert, or 1 $\mu$ Sv is equivalent to 1/1000<sup>th</sup> of 1millisievert or 1mSv); when the dose exceeds 10  $\mu$ Sv per year, then an approval from the regulatory authority is required.

In accordance with the report by the General Administrative Group of the Radiation Council, a guideline on safety management of the naturally occurring Radioactive materials(NORM) containing uranium and thorium<sup>2)</sup> was compiled and issued in June 2009 by the Subcommittee on Safety Regulations for Research Reactors, Etc. under the Ministry of Education, Culture, Sports, Science and Technology (available on the following website <http://www.norm-guideline.mext.go.jp/> ).

The guideline describes implementation procedures, where identification of target entities, provision of related information by target entities, and production of records are carried out. Keeping dose rate to a minimum level in the use of NORM is an important subject in radiation protection. Measures to be taken, however, may depend on the situation and site conditions. Development of a support framework of experts in this respect will also need to be considered.

Method on the management of NORM should be established, however further discussions by experts are necessary to solve the various problems.

### References

- 1) General Administrative Group, Radiation Review Council, "Exemption of NORM

(Naturally Occurring Radioactive Materials) from Regulations”

- 2) “Guideline For Ensuring Safety of Raw Materials and Products Containing Uranium or Thorium” 2009, The Ministry of Education, Culture, Sports, Science and Technology (MEXT)