

## 7. Report on Recent Status of TENORM in Viet Nam

### 7.1 Introduction

Naturally Occurring Radioactive Materials (NORM) and Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) are the new concepts for personnel, who work in the field of radioactive waste management in Viet Nam. Viet Nam has a variety of mineral resources, but exploration and exploitation of these mineral resources belong to Ministry of Resource and Environment, Ministry of Industry, and Oil and Gas General Bureau. The mineral resources concerned to NORM/TENORM are mainly crude petroleum, coal, phosphate ore, uranium ore, sand beach, tin, and rare earth. However, the exploitation of these minerals is very small, only the exploitation of coal and crude petroleum that is remarkable. The problem on TENORM in Viet Nam is the natural radionuclide in scales and sludge from petroleum industry and waste from sand beach processing are assembling and becoming harmful to the environment.

As the activity of the TENORM Management Task Group, The Viet Nam-Japan TENORM Discussion/Survey Meeting was implemented in Hanoi, Viet Nam on August 25-29, 2003. In this meeting, reports of NORM and TENORM status in Australia, Malaysia, Japan and Viet Nam were presented. The ways of cooperation on TENORM management within the Forum for Nuclear Cooperation in Asia (FNCA) framework was discussed.

### 7.2 TENORM Inventory in Viet Nam

In Viet Nam, there is no inventory of TENORM in all field of industry. Below is some data related to TENORM in the sand beach processing (Table 1) and radioactive waste from the activities of Institute for Technology of Radioactive Rare Elements (Table 2).

**Table 1 Inventory of TENORM in Sand Beach Processing\* (Data in 1999)**

Mineral	Capacity t/y	Quality	Equivalent dose ( $\mu$ Sv/hr)
Ilmenite	139,000	52% TiO <sub>2</sub>	0.7
Zircon	16,000	52% ZrO <sub>2</sub>	7-8
Rutile	17,000	85% TiO <sub>2</sub>	-
Monazite	Not known	35-40% R <sub>2</sub> O <sub>3</sub>	50-90

Note:\* most of produces was exported

**Table 2 Inventory of TENORM in Institute for Technology of Radioactive Rare Elements (ITRRE)**

Kind of TENORM	Estimated waste volume (t/y)	Radioactive content (%)	Equivalent dose ( $\mu$ Sv/hr)
Uranium ore (or tailing)	10-20	0.02-1%U	-
Monazite	5	-	42 -45
U, Th tailing from monazite pilot plant	4	-	100 - 102

### **7.3 Regulation on TENORM**

The responsibility of radioactive waste management belongs to Safety and Radiation Bureau, and Vietnam Atomic Energy Commission. Currently, Viet Nam has no special regulation for NORM/TENORM control, but there are some regulations concerned to it, such as:

- 1) Ordinance on Radiation Safety and Control (ORSC) (June 25, 1996).
- 2) Decree on the Detail Directions for implementing of ORSC (July 16, 1998).
- 3) National Standard on Radioactive waste management - Classification of RW (TCVN - 6868.2001)

### **7.4 Case Study Related to TENORM**

#### **7.4.1 Technical Visit to Phung Interim Storage Facility.**

The Phung Interim Storage Facility is operated by ITRRE and is located about 25km west of Hanoi. The gross area of the facility is about 20,000m<sup>2</sup>. In this site there is a Monazite pilot plant that was constructed in cooperation between Viet Nam and India and started its operation in 1992. But due to low demand of rare earth elements in Viet Nam, its operation was ended in 2001.

On this site there are one warehouse and two concrete tanks to store NORM/TENORM wastes generated from the pilot plant, the laboratories of the ITRRE, Uranium ore processing, and etc.

The waste containing Uranium is solidified by cement in yellow colored drums and their surface dose rates are about 10  $\mu$ Sv/hr (background dose rates are about 0.1  $\mu$ Sv/hr inside the office on the same site). The waste generated from the monazite pilot plant is packed into small bags and then packed into the blue colored drums, and their dose rates are about 50  $\mu$ Sv/hr and 13  $\mu$ Sv/hr at surface and 1 m from the surface of containers, respectively.

There were two concrete tanks. In these tanks about 130 tons of untreated waste containing Uranium and Thorium were stored. There was small treatment equipment that has been operated until last year. The level of the tanks was about 2 m. below the surrounding ground level. ITRRE planned to pile up soil and elevate the ground level. ITRRE will resume the treatment of waste in this year on the earliest schedule.

In 2004, ITRRE will upgrade the infrastructure of the facility, pile up soil and elevate the ground levels up to 2 m higher. Temporary vault for untreated radioactive waste, radioactive waste treatment house, and new house for treatment of radioactive wastes will be built. ITRRE is trying to get supports from the Ministry of Science and Technology (MOST) of Viet Nam, collaborate with IAEA and FNCA to upgrade the current laboratory for radioactive waste treatment and train key personnel and carry out researches on radioactive waste treatment and management.

## 7.4.2 Visit Thua Thien Hue Mineral Company

### a) Processing Facility

The company was founded in 1987. The number of workers is about 1,000 (processing 250: mining 750). Their business is the production of Zirconite, Ilmenite and Monazite from black beach sand. The typical dose rates in the facility were as follows:

- Background (conference room)	0.15	μSv/hr
- Raw material (black sand)	5.7	μSv/hr
- Zirconite	7-8	μSv/hr (at surface)
- Ilmenite	0.7	μSv/hr (at surface)
- Monazite	90	μSv/hr (at surface)

The dose rates in the workplace were in the range of a few μSv/hr. This means the annual dose of worker can be attained 6 mSv/y (2,000 work-hr in a year).

### b) Mining Site

The mining site is located near the beach, which is 30 km. far from the processing facility. The mining site was founded by the geochemical institute survey. Sand was pumped up with water from the bottom of the valley. Further, black sand was separated from white sand by weight difference method. Black sand produced was 150t/d. The typical dose rates in the site were as follows:

- White sand	0.15-0.20 μSv/hr
- Black sand	3.5 μSv/hr

## 7.5 Problems to be Solved

Viet Nam needs the Atomic Laws, which there are specifically regulations for NORM/TENORM management. In addition, personal training and upgrading of the infrastructure of the Radioactive Waste Management (RWM) facility is imperative problem.

Safety and Radiation Bureau and Vietnam Atomic Energy Commission should contact with other ministries who generate a remarkable amount of TENORM (i.e. oil scale and sludge, and monazite etc.) to find out the way to manage these waste

## 7.6 Conclusions

NORM/TENORM problems are very important to be considered. Before this time, natural radiation was not included in our radiation protection framework.

NORM/TENORM industries should be a target of radiation protection (to be regulated). Anyway, the origin of radioisotopes is natural. Criteria or standards used should be different from that of artificial source. Too strict regulation will cause much social and economical confusion