



NORM WASTE MANAGEMENT IN MALAYSIA

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Abstract

There are a number of industries generating NORM wastes in Malaysia. These include oil and gas and minerals/ores processing industries. A safe management of radioactive wastes is required. The existing guidelines are insufficient to help the management of oil and gas wastes. More guidelines are required to deal with NORM wastes from minerals /ores processing industries. To ensure that radioactive wastes are safely managed and disposed of, a National Policy on the Safe Management of Radioactive Waste is being developed which also include NORM waste. This paper describes the current status of NORM waste management in Malaysia.

1. INTRODUCTION

Malaysia has only one 1-MW Triga Mark II nuclear reactor, located at the Malaysian Institute for Nuclear Technology Research (MINT), used for research purposes. Thus, nuclear waste is yet a problem in the country. Much emphasis is being given to the handling of NORM wastes due to the existence of a large number of industries involved in the processing of Naturally Occurring Radioactive Materials (NORM). Oil and gas and minerals/ores processing industries are the main contributors to the generation of NORM wastes.

The operations of NORM industries are controlled under the Atomic Energy Licensing Act 1984 enforced by the Atomic Energy Licensing Board of Malaysia (AELB). The act superseded the previous Radioactive Substances Act 1968. AELB is developing more regulations and guidelines in order to ensure safe handling of radiation sources including NORM. NORM processing operators require licenses from AELB to operate. Licensees have to meet the requirement of the license conditions set by AELB. Industries usually engage consultants to comply with the requirements. MINT is one of the consultants which provides a wide range of services to the industries. This includes the management of radioactive waste through its National Radioactive Waste Management Center, preparation of Radiological Impact Assessment (RIA), providing Radiological and Environmental Monitoring, Radioactive Balance Analysis, operational safety analysis and NORM analysis. This paper describes the current status of NORM waste management in Malaysia.

2. NORM INDUSTRIES

2.1. Oil and Gas

As in other parts of the world, Malaysian oil and gas industries are also producing radioactive wastes in the form of sludges and scales. Radionuclide concentrations in Malaysian sludges have been reported to be low (1,2). The level of radionuclides concentration in scale are generally low, but show quite significant amount of radium. For instance, one sample has been detected to contain an activity of 160 Bq/g and 250 Bq/g of Ra-226 and Ra-228 respectively. However, the volume of the scales generated is small as compared to sludges in which about 500 tonnes of sludges are generated from one crude oil production terminal (COPT).

2.2. Minerals/Ores Processing

2.2.1 Tin Smelting

Malaysia is one of the major world's tin-producing countries. Tin ingot for export is produced from two smelting plants. In smelting process, tin ore concentrates which contain significant amount of radioactive minerals such as monazite, zircon and ilmenite were used as raw materials. In the process, tin slag containing naturally occurring radionuclides (NOR) is generated as waste. The concentrations of radium-226 (uranium series) and radium-228 (thorium series) in tin slags are 2 Bq/g and 3 Bq/g respectively (3).

2.2.2 Rare Earth

Rare earth industry was in operation in Malaysia from 1982 to 1992 which left quite substantial amount of radioactive NORM wastes. Under a license from AELB the waste is stored at a long-term storage facility. The industry previously processed xenotime and monazite minerals to produce rare earth. The wastes generated from minerals processing include xenotime sludge (190 Bq/g Ra-226, 250 Bq/g Ra-228), thoria (0.45% U, 0.5% Th), lead cake (26 Bq/g Ra-226, 350 Bq/g Ra-228) and tri-calcium phosphates (0.1 Bq/g Ra-226, 0.6 Bq/g Ra-228) (3).

2.2.3 Titanium Dioxide

Titanium dioxide (TiO_2) is produced from ilmenite or synthetic rutile. There are two companies producing TiO_2 using sulphate and hydrochloric processes. Red gypsum (0.1 Bq/g Ra-226, 0.06 Bq/g Ra-228) and iron oxide (0.7 Bq/g Ra-228, 0.9 Bq/g Ra-228) are produced as solid wastes (3).

3. REGULATORY CONTROL

As for wastes from oil and gas industries, LEM/TEK/30 Sem. 2, a guideline issued by AELB is used. The guideline spells out the need for a Radiological Impact Assessment (RIA) to be carried out for the disposal of waste from oil and gas industry. If the RIA shows that additional radiation dose to the member of public is less than 1 mSv/y, then the disposal by landfill will be exempted from control.

In practice, AELB is using a constraint limit of 0.3 mSv/y. A Code of Practice is being developed by a committee set up by AELB to encompass more comprehensive guides for the industries. With regard to treatment of wastes, dose assessment is required prior to approval from AELB. In some cases, radiological monitorings are required to be carried out during the treatment. As for NORM wastes from minerals/ores processing, there is no specific guideline for its management. However, AELB usually issues license with conditions to be fulfilled by the licensees. RIA is also needed for the landfill disposal management of NORM wastes from minerals/ores processing.

4. WASTE MANAGEMENT

4.1. Oil and Gas

At the moment, management of sludge and scales are controlled by AELB. Some companies apply sludge farming method to treat the waste in order to remove the hydrocarbon content through bio-degradation process. This method is simple and cheap but the process is very slow and it requires a large area of land. Extraction method is also used to reduce the volume of the sludge. Incineration is another alternative to remove hydrocarbon content. The final waste from treatment processes (matured sludge, extraction residues and ash) need to be disposed of properly with the approval from AELB.

Disposal of NORM waste is still a problem. For low-level activity waste, landfill disposal is one of the potential options. There are companies applying licenses to dispose of their matured sludge by landfill at the companies premises. MINT was asked by the companies to come up with the RIA reports for consideration by AELB. To undertake the task, a computer code, RESRAD, developed by Argonne National Laboratory US was used.

4.2. Mineral/Ores Processing

Tin slag from a tin smelting plant was used to reclaim a piece of swampy land which will be used as a site for building a warehouse. RIA was carried out by MINT prior approval from AELB. RESRAD was also used for dose assessment.

Xenotime and monazite processing wastes were initially dumped in ponds and in drums at the company's premise. Later, all the waste was dug out from the pond and transferred into steel drums. The drums were then transported to the long-term storage facility. This facility is a proper building with concrete bays which could hold more 20,000 tonnes of wastes. Radiological and environmental monitoring is being carried out at this facility to monitor possible release of NORM into the environment. Studies have been carried out by MINT to condition the waste by cementation. It turns out to be quite costly. Thus, the final disposal can possibly be carried out with or without conditioning. As the company ceased its operation, there is a need to decommission the plant. Contaminated soil and plant components are planned to be sent to an engineered cell at the long-term storage facility.

The wastes from TiO₂ plants are voluminous. Iron oxide seems to have significant radioactivity level as compared to red gypsum. The waste is temporarily dumped at companies' premises. There is no final solution this wastes as yet.

In an industry where zircon and other mineral are used for polishing glass panel, sludges are produced as wastes. As radioactivity level of the wastes is low, the sludge is sent to an authorised private company specialised in treating/conditioning and disposing hazardous chemical wastes.

5. POLICY

The government of Malaysia is now developing a National Policy on the safe management of radioactive wastes. The policy also covers NORM waste.

6. REMARKS

Management of NORM waste is still a problem in Malaysia. Only very low-level waste is possible to be disposed of as landfill materials. More guidelines are required to solve the disposal problem of NORM wastes.

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