Annex 3

Session Summaries of

FNCA 2022 Workshop on

Radiation Safety and Radioactive Waste Management Project

Session 3 : Consolidated Report on NORM/TENORM

1) Australia (Mr. Duncan Kemp, Australian Nuclear Science and Technology Organisation (ANSTO))

This discussion looks at the ways to improve NORM management within Australia. There is a strong regulatory framework in Australia to manage NORM, provided by National Guidance in Radiation Protection Series 15 - Safety Guide - Management of Naturally Occurring Radioactive Material (NORM). There are nine jurisdictions within Australia and they each have their own way to defining and regulating NORM. A recent review of NORM regulation was undertaken by the Radiation Health and Safety Advisory Council (Australia's peak scientific advisory council on radiation safety matters). This discusses that review and the recommendations. The recommendations are to have international involvement, maintaining a leadership role, developing a graded approach, international trade implications and communication.

2) Bangladesh (Dr. Khandoker Asaduzzaman, Bangladesh Atomic Energy Commission (BAEC))

Concentration of naturally occurring radionuclides (NORs) in industrial products and by-products may become enhanced due to various industrial processes and subsequently form NOR enriched deposits/wastes (for example, sludge, scales, produced water, pigging debris, discharges, residues etc.) within production facilities thereby forming TENORM. National organization and legal & regulatory framework for radioactive waste management including NORM/TENORM will be outlined in the presentation. The existing policy and regulatory clearance of NORM radionuclides has been highlighted. The probable NORM/TENORM industry/sources in the country are mentioned. Lastly, present NORM characterization and management and some challenges are also briefly discussed in the presentation.

3) Indonesia (Dr. Dadong Iskandar, The National Research and Innovation Agency (BRIN))

In the recent years the activity related to NORM/TENORM Management in Indonesia has increased. In this report we will just describe the TENORM Management. The sources of TENORM in Indonesia are from mining and industry as tin mining and processing, oil and gas company, coal power generation, etc. The procedures of TENORM Management in Indonesia, in general, the company generated TENORM should make radiological study to know what kind of radiation protection should be applied. If there are any contaminated sites, they will ask to make a clean-up for these sites. The TENORM residues/wastes would be stored at their own interim storage. Indonesia has no final disposal for the TENORM Wastes. In the Report we also describe regulatory infrastructure

in Indonesia and also how it's implementations. The issues related to TENORM in Indonesia are: 1) The conflicting and inconsistent norms in some regulations in Indonesia, therefore the coordination among authorities is necessary to establish the national system of TENORM management in Indonesia; 2) Workers in Industry generated TENORM still have low knowledge of radiation protection; 3) Interim storage of TENORM residue/waste has a very limited areas with poor quality; 4) Indonesia has no a final disposal for TENORM waste.

4) Japan

① (Mr. Tatsuo Saito, Japan Atomic Energy Agency (JAEA))

As this country report of Japan, I'll introduce here 2 topics:

1. Exemption from regulation of natural radioactive substances
2. Guideline for Ensuring Safety of Raw Materials and Products Containing U or Th

In summary, I'll report as follows;

- Japan has two guidelines for NORM. The first is for NORM categorization with its containing minerals or generic streams, into 8 groups to lead to each guideline dose (1 mSv/y or 10 μSv/y) for action/exemption.
- The second guideline is for ensuring safety of NORM with preparing measures by screening with flow chart of guideline radioactivity (1 or 10 Bq/g) to the targeted manufactures and consumer goods for exposure reduction.

② (Hiroshi Yasuda, Hiroshima Univ.)

The radioactivity of the waste contaminated with natural uranium and its progeny nuclides, so-called "uranium waste", cannot be expected to reduce over hundreds of thousands of years; rather, potential exposures of future generations could be more significant than that of our generation, while it is characterized by being a nuclide that exists in the natural environment from the immemorial time. From the perspective of human history, it is natural to think that these legal systems and the thoughts underlying them will become unclear in the not-too-distant future and will not be understood by future generations. To make a solution with consideration of these peculiar problems, we need more investigations from the viewpoint of not only natural science/engineering but also humanities/social sciences including history, archeology, philosophy, linguistics, etc. Some insight on this topic is to be presented.

5) Kazakhstan (Mr. Vycheslav Gnyrya, Institute of Atomic Energy of the National Nuclear Center of the Republic of Kazakhstan (IAE NNC RK))

One of the main tasks facing the world community was the problem of handling of ionizing radiation sources, radioactive waste and spent nuclear fuel resulting from human use of nuclear energy. This issue is also relevant for Kazakhstan. Firstly because of the large amount of accumulated on the former grounds of nuclear tests and is continuously generated at the enterprises of the uranium industry and in medical institutions of radioactive

waste. Secondly, due to the presence on the territory of Kazakhstan of five nuclear reactors, which are the main sources of spent nuclear fuel.

A large amount of NORM/TENORM radioactive waste has been accumulated in Kazakhstan and there is a tendency to an increase in its volume, which requires ensuring safe management of its, including disposal. NORM/TENORM materials are represented by wastes of uranium mining, oil and gas production, metallurgical industries in the form of dumps, tailings, contaminated soils, pipes, equipment, and so on.

To regulate the handling of radioactive waste, ionizing radiation sources and spent nuclear fuel management in Kazakhstan, a number of documents in the form of Laws, Regulations and other normative legal acts are being developed and revised on an ongoing basis. But despite the fact that Kazakhstan has a lot of experience in this area, nevertheless, there are tasks in the regulatory legal framework and infrastructure of nuclear energy facilities that require compulsory solutions in the near future.

6) Malaysia (Dr. Mohd Zaidi bin Ibrahim, Malaysian Nuclear Agency)

In Malaysia, any activities involving Naturally Occurring Radioactive Materials (NORM) are regulated under the provisions of the Atomic Energy Licensing Act 1984 [Act 304]. Mineral processing, oil and gas, and tin mining are the main industries involved with activities related to NORM. Clearance level are used to determine whether the control of activities involving NORM are subjected to Act 304 and must comply with all aspects of licensing, regulation, and safety to ensure the safety of workers, public, and environment. Guides, codes, and standards are provided by the regulator to ensure all licenses comply with requirements and the goals imposed in regulations are achieved. Residues containing NORM less than clearance limits are regulated under Environmental Quality Act 1974 (Act 127).

7) Mongolia (Ms. Batdelger Uranchimeg, Nuclear energy commission of Mongolia)

Mongolia is a developing country without nuclear industries. Radioactive waste is generated from radioisotope applications in medicine, research, agriculture, geology, mining, and industries. These wastes are not well characterized and stored in less than adequate conditions. The generation of disused radioactive waste is centrally stored at the Isotope Center (IC), which was constructed in 1987.

The huge volume of naturally occurring radioactive materials (NORM) wastes produced annually by NORM related industries in Mongolia and it deserves to come to the attention of national environmental protection agencies and regulatory bodies. NORM wastes constitute, by and large, unwanted byproducts of industrial activities as diverse as coal, copper, zinc, lead and rare earth mines, oil and gas wells. In many of these branches of industry, the problem of naturally occurring radioactive materials is present.

The main source of risk for workers and public is the short-lived radon daughter products present in air. This source of risk is present in Mongolia, due to its geological condition. Most of the territory of the country is presented by granite with enhanced concentration of uranium.

These granites are the main source of the uranium in radioactive mineral deposits and NORM in other non-

uranium mining sites and lakes. Currently, the NORM regulation is on final stage of approving by the Government of Mongolia. Most concepts (graded approach, exemption, notification, authorization etc.) are already included in the Mongolian regulatory framework.

As of March 2020, there are 69 coal mines, 23 mines of other mineral resources, 4 rare earth mining, 2 oil exploiting company has valid exploitation licenses and 13 TPPs, 144 building material factories under the sampling program for control of NORM by the regulatory body. NORM generating industries have not been identified in the country completely. Radon issue is not yet explicitly mentioned in the Mongolian regulatory framework apart from some articles in different documents. Radon Action Plan is not approved and Radon Survey was not carried out in Mongolia. Regulatory limits for workplaces, mining sites. Indoors (1110 Bq/m³ for workplaces, 200 and 100 Bq/m³ for existing and new buildings, respectively) specified in national BSS (2015). General agency for specialized inspection /MES/ and its branch Metropolitan inspection agency /MIA/ started to carry out some Radon measurement campaigns in public buildings such as schools, kindergartens in Ulaanbaatar during last several years. Lack of laboratory capacity, human resources and absence of National radon action plan are the main challenges for NORM regulation in Mongolia. However, a limited number of instruments from various manufacturers is currently in use, but unable to ensure the required Quality Control of radon measurements in the country. The large distances need to be travelled to carry out a nation-wide radon survey in Mongolia is also challenging task. Therefore, international cooperation (e.g. with the bilateral or the regional) is important for strengthening of regulatory control of NORM residues and also establishment of nationwide radon survey in Mongolia

Besides, since the beginning of uranium prospecting in 1945, more than 12 uranium deposits, 100 hundred uranium occurrences, around 1400 anomalies have been discovered within Mongol-Priargun, Gobi-Tamsag, Khentei-Daur, Northern Mongolian metallogenic provinces. Mongolia is the 11th ranking uranium resources in the world. The Badrakh Energy Co Ltd has been tested Dulaan- uul project which done by in-situ technology, and after two years of pilot operations, approximately 20 tons of uranium will be produced during operation, and over 260 tons of radioactive waste generated per year.

8) The Philippines (Ms. Kristine Marie Romallosa, Philippine Nuclear Research Institute (PNRI))

The overview of potential sources of naturally occurring radioactive materials in the country are discussed. The sources are from coal mining and industry, mineral mining of copper, gold, iron among others, oil and gas exploration and fertilizer industry.

There are several R&D activities on characterization of NORM Levels in PH. This includes the radioactivity concentrations in soil, some building materials, NORM industries such as coal and minerals processing, and radon levels. The goals of these studies are for policy recommendations on radiation protection and management of NORM.

Not specific to NORM / TENORM, but exemption concentrations including bulk amount of solid materials, above which will need regulatory control is indicated in the regulations. But there is still no existing policy and

legislation on the control and management of NORM in the Philippines. Although there are some regulations with regards to radioactive waste management which covers the requirements for the management of wastes arising from NORM processing, these industries are currently not regulated.

Current, waste management options do not include NORM / TENORM. There was an IAEA Occupational Radiation Protection Appraisal Service (ORPAS) Mission that was conducted in 2022 and among the main recommendations is for the country to establish and enforce requirements for the protection of workers. With this, it is hoped that more progress will be made in terms of policy and regulation of NORM/TENORM in the near future.

9) Thailand (Dr. Klitsadee Yubonmhat, Thailand Institute of Nuclear Technology (TINT))

Studies on NORM/TENORM waste generated in Thailand were introduced in 2002 and the information on NORM types, quantities, and sources remains scarce. Natural radionuclide contents in various contaminated materials were investigated and the results showed that NORM found in some materials were highly enhanced, especially the precipitate/waste from the tantalum processing and the residues from the disused rare earth processing facility. However, more NORM/TENORM waste studies are needed so as to acquire NORM information from all sectors that could generate such waste. This could not only improve the protection of the public and the environment from the potential risks due to the natural radiation from NORM/TENORM waste but also assist the development of national NORM regulatory programs. The NORM/TENORM contaminated materials from abroad require special attention, because they were brought unintentionally into the country. Here, the capability and availability of the radiation surveillance systems at the importation gates should be checked. There will be a problem with the inadequacy of the RWMC's storage space for NORM/TENORM contaminated materials. This problem might be also aggravated if the ministerial regulation being drafted is promulgated.

10) Vietnam (Mr. Nguyen Thanh Thuy, Institute for Technology of Radioactive and Rare Elements (VINATOM))

Naturally occurring radioactive material (NORM) and technologically enhanced naturally occurring radioactive material (TENORM) are generated in Vietnam by the uranium, rare earth, mineral placers mining and processing, and other resources sectors. Vietnam is in rich coastal resources with placer reserves of over 650 million tons. Placers are mainly concentrated in central Viet Nam. Some minerals can be separated from mineral placers such as Ilmenite, Leucoxene, Rutile, Zircon, Rare Earth minerals, and Monazite. NORM is usually generated during this mineral beneficiation. This rad-waste is buried at the mining site. TENORM comes from zircon and monazite production. It is transported to the licensed disposal location and buried underground with strict standards.

Because of the stopping of the first nuclear plant (located in central Ninh Thuan province) project, uranium mining, and processing in Vietnam have also stopped in 2016. 100 tons of uranium tailing from the state project (2012) on reserve searching and evaluating of 8000 tons of U3O8 were treated and disposed of by shallow

geological burial method before the stopping decision. Current research on uranium is being carried out on a small scale in research facilities. The amount of generated NORM/ TENORM is now relatively small.
Vietnam has a large rare earth reserve (over 20 million tons), in which some minerals have radioactive activity like monazite and xenotime. There isn't any deep rare earth mining plant in operation in Vietnam. NORM/TENORM related to rare earth was born primarily from research activities. These rad wasted were treated and managed in the temporary warehouse of rare earth companies and research institutes.
In general, the NORM and TENORM in Viet Nam were relatively well managed but there are some problems related to these rad-wastes:

- Upgrade or expand the small existing radioactive waste management facilities.
- Develop management documents related to radon gas in houses in high rise buildings and in underground public works, and mines.
- Improve the capacity of state management agencies to be able to control all NORM/TENORM related industries in order to prevent environmental incidents and accidents related to NORM/TENORM.
- Strengthen the capacity of technical assistance agencies in appraisal and assessment related to exemption, licensing, liquidation as well as environmental monitoring for NORM/TENORM waste landfill sites.

Session 5：Topics

1) International Movement of NORM/TENORM

Dr. Hashimoto Makoto (Japan Atomic Energy Agency)

International organizations have been worked on NORMTENORM. Items in below looks important actions.
ICRP published Publication 142, 'Radiological Protection from Naturally Occurring Radioactive Material (NORM) in Industrial Processes' in 2019. It recommends that NORM presents no real prospect of radiological emergency and optimized radiation protection complement already placed hazard management. Reference levels were indicated.
IAEA held international conference 'management of naturally occurring radioactive material (NORM) in industry' in 2020. Proceedings was issued in 2022. Many actions made by many countries ware introduces and discussed. It looks it contributed to make the specific safety guide No. SSG-60 'Management of Residues containing naturally occurring radioactive material from uranium production and other activities' in 2021.
EC published documents for radiation protection from TENORM. In 1999. EC established reference levels for regulatory control of work places effected with TENORM. USEPA published information about TENORM in USA. WNA summarized NORM information in the world.
These actions are based on the data in the science report of UNSCEAR issued several times from 1977.

2) Environmental radiation related to Radiation Waste Management

Prof. Yamanishi Hirokuni (Kindai Univ.)

Introduction report about "Discharge of ALPS treated water" by using public materials from METI and TEPCO

Mid-and-Long-Term Roadmap towards the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station (FDNPS) Units 1-4 1)

Firstly adopted in December 2011, the Mid-and-Long-Term Decommissioning Roadmap clarified that the Government of Japan (GOJ) lead the entire decommissioning effort. Since then, GOJ revised the roadmap several times to set appropriate milestones and timeline.

Water management 2) (One of the key issues); Water for cooling fuel debris touches that debris, and thereby becomes highly contaminated water containing highly concentrated radioactive materials. New contaminated water is generated due to mixing of this highly contaminated water with groundwater and rainwater that flow into buildings. For example, putting impermeable (frozen-soil) wall led successful reduction of the amount of generating contaminated water and removal of stagnant water.

ALPS treated water 3); "ALPS treated water" is the water which has been purified from contaminated water and in which the radioactive materials are removed by ALPS (multi-nuclide removal equipment) to meet the regulatory standards with an exception of tritium. The number of storage tanks on the site exceeds a thousand, which could be an obstacle to secure a site for the planned decommissioning of the plant.

How to discharge the ALPS treated water into the sea 3) ; Concentrations of the radioactive materials will be far below the regulatory standard values by 1) purifying/re-purifying the radionuclides other than tritium; and 2) diluting by sea water. Discharge into the sea at the FDNPS will be monitored/reviewed by third parties such as IAEA.

Decision-making process handling treated water 4) ; Contaminated water that has been treated and purified is being stored in tanks at the FDNPS. At current time, the Japanese government is deciding what to do with this water while basing its decision upon reports from the Subcommittee on Handling of the ALPS Treated Water, the opinions of stakeholders, such as the residents of Fukushima, and while also considering measures to prevent damage caused by harmful rumors. TEPCO will appropriately handle this treated water based upon the policy stipulated by the government. Regardless of the treatment method employed, they will comply with legal requirements and engage in measures to avoid damage caused by harmful rumors.

Reference

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