

**International Conference on Occupational Radiation Protection:
Strengthening Radiation Protection of Workers –Twenty Years of Progress
and the Way Forward**

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Occupational Radiation Protection in the Oil and Gas Exploration Involving Exposure to Naturally Occurring Radioactive Material (NORM) Waste Product

The oil and gas exploration industry was well known to indirectly generate Naturally Occurring Radioactive Material (NORM) waste products known as oil sludge and scale. Oil sludge and scale formed during the borehole logging process in the process to obtain crude oil from the reservoir rock. In this process, various impurities were sucked out which eventually precipitation and deposition were formed in the oil and gas production tubulars, valves, pumps, and transport piping systems. The waste products are commonly associated with natural radioactivity of ^{226}Ra , ^{228}Ra , ^{210}Po from ^{238}U and ^{232}Th series and also ^{40}K . In addition, this process might involve the presence of radon (^{222}Rn) which formed the thin radioactive lead films on the inner surface of gas processing systems.

Malaysia which is vastly known in oil and gas exploration is also not excluded from the generation of oil sludge and scale waste products. In Malaysia, any activities related to NORM waste products are regulated under the Atomic Energy Licensing Act 1984 (Act 304). In terms of licensing requirements, the value of the Clearance Level stipulated under the Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011 is used to determine the control of NORM waste products whether or not, the waste is subjected to the control under Act 304. The value of the Clearance Level or activity concentration values which less than 1 Becquerel per gram (Bq/g) for ^{238}U or ^{232}Th and less than 10 Bq/g for ^{40}K is not subjected to the licensing under Act 304. If the activity concentration of the stated radionuclides exceeds or equals the values of 1 Bq/g and 10 Bq/g respectively, then the activity is subjected to the licensing under Act 304.

The offshore oil platform facilities located at the seashore of Malaysia dealing with the oil sludge and scale waste products shall take into account the radiation protection aspect during the operation, maintenance, and decommissioning and also subsequent disposal of the waste products containing NORM. The operators closely dealing with the heavily scaled piping systems may also be subject to radiation protection measures. In doing so, the facilities must be monitored to distinguish between NORM waste and miscellaneous waste. The operators must conduct the Operation Radiation Safety Assessment (ORSA) which may include monitoring during normal operation (Routine Radiological Monitoring, RRM) and maintenance works (Specific Radiological Monitoring, SRM). The ORSA parameter may include the measurements of external dose rate, surface contamination level, airborne dust activity level, and radionuclide activity concentration. Thereafter, the decontamination can be performed at the location of the oil and the scale suspected to appear.

Most of the monitoring activities are conducted at the processing plant of onshore and offshore oil platform facilities at the Peninsular of Malaysia, Sarawak, and Sabah. From the monitoring activities, the result indicates that all parameters monitored during RRM in normal operations are below the limits regulated under the Atomic Energy Licensing (Radioactive Waste Management) Regulations 2011.

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