

Offshore radiometric surveys for identification of NORM deposits

Identification of areas with accumulated NORM, ensuring the radiological safety for FPSO personnel.

The Challenge

NORM (Naturally Occurring Radioactive Material) is commonly found in seabed rock formations and oil wells. Due to the oil extraction process, this radioactive material is carried along with produced oil and water, reaching the surface and going through the entire production process on an offshore unit.

With continuous production and operation time without equipment cleaning, this material containing NORM tends to accumulate in pipes, separators, filters and valves as incrustations or sludge. Although it is a low specific activity (LSA) material, the accumulation of this radioactive material, over years of operation, can result in an extremely high dose rate value, which represents a radiological risk for offshore workers.

In order to identify areas with NORM deposits and to guarantee the radiological protection of offshore workers, a complete radiometric survey is necessary in all areas where there is oil and produced water. The value at each measured point must be compared with the value of BG (background), to identify places of a significant variation to BG.

The Solution

The radiometric survey in offshore units aims to identify places with NORM deposits. This type of service must be performed by specialists in radiation protection using specific monitoring equipment to identify this type of material.



The Radiation Protection Advisory (RPA) services rely on specialists with years of experience accumulated on NORM management around the world, as well radiation monitors designed exclusively for a precise identification of places with radioactive material deposits.

Since no radiometric survey had ever been carried out on this unit, prior to NORM specialists arriving on site, drawings of the unit's equipment and lines were requested in order to verify and identify places that were more likely to have NORM deposits. Those locations were highlighted and identified for the service planning.

Led by a Radiation Protection Supervisor (RPS), the radiometric survey was carried out by two specialists who were experienced in radiation protection and NORM identification. Each of the specialists were responsible for using a specific intrinsically safe radiation monitor - the Tracerco™ NORM monitor-IS and the Tracerco™ T202 dose rate monitor, in order to guarantee the accuracy of the readings obtained during the radiometric survey.

During the job, Tracerco's specialists were equipped with a personal electronic dosimeter (PED), which allows the real-time reading of dose rate values in the locations where radiometric surveys are being carried out. The PEDs also acted as a second source of detection for exposure to ionising radiation.

In each of the locations where the radiometric survey was carried out, whether separated by modules or environments, the BG value was registered in order to verify possible variations in the values obtained during the measurement locations.

The radiometric survey started at the points identified during the planning stage as the most likely to accumulate NORM. All lines and connections were monitored before and after each of these locations, depending on the values obtained.

No significant dose rate variations were detected during the inspections in the oil lines, indicating a low probability of NORM deposits - even in places where internal monitoring using the contamination probe was possible.

In the produced water lines and equipment where the produced water was abundant, the behaviour of the dose rate values was quite different. In the early stages of the process, it was possible to identify significant changes on the dose rate and contamination values, compared to the BG value. Whilst monitoring, it was noticed that as the production process progressed, the dose rate values increased.

Towards the end of the production process, in places where there was some type of restriction in the flow of water, dose rates higher than the limit established by the current legislation were found. However, the highest value obtained in the radiometric survey was identified while Tracerco's team of specialists moved from one monitoring location to another. The PEDs alarms were set off, warning of an increased dose rate in that location.

The reason for the sudden increase in the dose rate was investigated immediately and the root cause was found in inoperative equipment (that was scheduled for maintenance). The value found exceeded the allowable public dose rate by eighteen times. After identifying and confirming the values, Tracerco immediately contacted the FPSO's HSE teams and provided them with the appropriate recommendations for the necessary measures to identify the location of NORM and to establish barriers to avoid exposure.

The Conclusion

The radiometric survey was carried out in the entire production area of the unit, in places where there was a flow of oil or produced water.

All values obtained during the survey were highlighted as places where the dose rate values already exceeded the limit, and places where the dose rate values should be monitored moving forward.

The maintenance of the equipment that presented dose rate readings above the limit for an individual was postponed until full cleaning and decontamination was performed on the internal part of the equipment. After cleaning, a new radiometric survey will be carried out on the site so that the maintenance of the equipment is authorised.

The radiometric survey service at the unit will be carried out annually, in order to comply with the current legislation on radiological safety for offshore workers. The places classified as potential NORM deposits have been identified and are included in the unit's environmental risk prevention program, so that they are evaluated annually for increased dose rate.

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