

Tritium analysis in hydraulic oil waste by oxidation technique

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The aim of the present study is to investigate a method to evaluate the tritium activity in hydraulic oil waste generated during the operation of Romanian Cernavoda Nuclear Power Plant. This study is useful to provide data for tritium inventory calculation.

The method is based on a combustion technique using the model 307 PerkinElmer[®] Sample Oxidizer. The following step after combustion is assessing the tritium activity by liquid scintillation spectrometry, the region of interest being from 0 keV to 18.6 keV. By this method, stable, clear and homogeneous samples suitable for analysis by liquid scintillation counting were obtained.

In the hydraulic oil waste tritium may exist as organic matter. Therefore, in this work organic tritium standards were used.

Prior to combustion of the hydraulic oil waste, tritium recovery degree and tritium retention degree in the circuits of combustion system were evaluated using an organic tritium standard and hydraulic oil to obtain a matrix similar to the organic oil waste. For the blank samples, an inactive organic oil solution was obtained in the same manner as the tritium organic oil, but without tritium radionuclide.

Tritium activity was measured by a 2100 Tri-Carb[®] Packard model liquid scintillation analyzer. A tritium window was used for the measurement of tritium, the samples and blank being measured for 300 minutes.

The degree of tritium recovery in the analyzed standard samples was higher than 98%, and the tritium retention degree in the circuits of combustion system was less than 0.08%.

The blank counts were 9.92 ± 0.36 counts/min, measured for 300 min. The Minimum Detectable Activity (MDA) was calculated to 1.73 Bq/mL for a 0.2 mL hydraulic oil sample. Therefore, the developed method is sensitive enough for the tritium evaluation in the ordinary hydraulic oil waste samples.