

A CASE STUDY ON THE ABILITY TO MEASURE TRITIUM IN MATERIALS USING IBA, AUTORADIOGRAPHY AND LIBS

THE TRANSAT PROJECT

FOCUSES ON OBTAINING A
RELIABLE DIAGNOSTIC TO
CONFIRM OR INFIRM THE
PRESENCE OF TRITIUM IN
CASE OF CONTAMINATION

In fission or fusion facilities, monitoring tritium inventory is crucial. When tritium is in liquid or gaseous forms, some commercial analytical systems already exist with high sensitivity and high precision. However, for tritium adsorbed on the surface or under the surface of a solid, analytical systems are rather rare and this is the reason why new systems were developed as part of the TRANSAT project.

Three techniques have been developed: ion beam analysis (IBA) method, autoradiography and laser induced breakdown spectroscopy (LIBS), which was not tested directly on solid samples contaminated with tritium. IBA and autoradiography are not destructive whereas LIBS is locally destructive.

TECHNOLOGIES

IBA

- Advantages: quantitative measurement on surface and in depth, non-destructive technique
- Future R&D: tests on different tritium sources

Autoradiography

- Advantages: Sensitivity, easy to use, tritium cartography, non-destructive technique
- Future R&D: robustness, tests on different tritium sources

LIBS

- Advantages: remote sensing, quantitative profile
- Future R&D: sensitivity, applicability to tritium

KEY RESULTS

This case study demonstrated the possibility to analyse tritium with IBA technique using nuclear reaction both on the surface and in depth, the successful use of a new commercial system for autoradiography with SIPM detectors and Measure with Digital Autoradiography (MAUD) as an efficient means of detecting and quantifying tritium on the surface, enabling localisation and inventory even at trace levels.

It was also determined that obtaining dedicated tritium solid sources is essential to measuring the efficiency of new measurement technologies, and the development of the three techniques was key to obtaining robust techniques, calibration curves, efficiency, robustness and a quantitation limit.

In conclusion, highlighting the robustness of all different systems in terms of tritium inventory and the ability to use the systems in a restricted area are both important aspects of obtaining a reliable diagnostic.