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# Development of a Methodology to Detect Fluorine in Uranium Bearing Particle by SIMS

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The isotopic analysis of micrometer-size uranium bearing particles, released from nuclear facilities, has been proven to be an efficient tool for safeguard purposes. The French atomic energy agency has developed analytical techniques to detect traces of uranium in these micrometric particles. However, isotopic measurements are not always sufficient for identifying specifically some crucial nuclear operations, like uranium conversion, which are most of the time carried out with natural uranium. Conversion and enrichment activities may lead to releases to the atmosphere of particulate UF4 and/or UO2F2 material. So, the detection of a significant amount of fluorine in such uranium particles is a proof that uranium has been converted at one point before the sampling. Therefore, CEA developed a methodology to detect and analyze by SIMS (secondary ion mass spectrometry) micrometer-size particles that contain both uranium and fluorine as an indicator of this conversion activity. Following the particle detection, which is performed automatically, individual particle are analyzed in microbeam conditions to measure both a precise uranium isotopic composition and the relative amount of fluorine. The methodology was applied to uranium particles coming from the fuel cycle upstream the enrichment step. This study demonstrated that, contrary to uranium isotopic measurements, the measurement of the relative amount of fluorine allowed discriminating between uranium-ore concentrate particles and particles coming from a conversion plant. Moreover, the results, obtained on particles collected five years ago in the surroundings of a conversion plant, showed that fluorine is a persistent indicator of a conversion activity. The analysis of these particles enabled to establish a database, which was successfully used to draw conclusions from the analysis of unknown real-life environmental samples.

## Country or International Organization

France

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