# An ICP-MS analysis on aerosol from simulated nuclear fuel, to study the elemental composition of particles released during nuclear accident.

F.G. Di Lemma[1, 2], J.Y. Colle[2], G. Rasmussen[2], S. Van Winckel[2] and R.J.M. Konings[1, 2]

[1]Department of Radiation, Radionuclides & Reactors, Faculty of Applied Physics, Delft University of Technology, Delft, 2629JB, The Netherlands.
[2]European Commission, DG Joint Research Centre, Institute for Transuranium Elements, P.O. Box 2340, D-76125, Karlsruhe, Germany.
Keywords: Nuclear aerosols, Accident Aerosol characterization, ICP-MS.
Presenting author email: fidelma.DI-LEMMA@ec.europa.eu

Source term analyses are essential when evaluating the consequence of accidents and sabotages involving nuclear and radioactive material. Source term analyses means to perform a quantification and characterization of the releases, involving both radioactive aerosols and radioactive gaseous species. The radiotoxicity of the release and so the related health risk for the population depends on its elemental and isotopic composition. Our study concentrates on evaluating the elemental composition for aerosol formed during these events through a novel experimental Set-up RADES (described by Dilemma et al. (2012)). This Set-up permits to simulate RDE's (Radiological Dispersion Events) by applying a wide range of heating transients to a variety of materials and creating aerosols under controlled conditions.

Simulated fuel, consisting of $ZrO_2$ doped with chemicals to simulate fission products (1%w. BaO, 1%w. CsI, 1%w. Pd), was tested in our setup. A rapid high temperature transient, was applied to a pellet, which was created by pressing the described powder. Aerosols were formed in a controlled atmosphere (1015 Pa pressure, room air at room temperature) and collect through a MOUDI impactor (MSP 100) working at the operating flow (30 SLPM). Aerosol were collected separated by their AED (Aerodynamic Equivalent Diameter) on 47 mm diameter aluminium foil substrates, these were then washed out with 20 ml of ethanol in an ultrasonic bath. The solutions are then further prepared and analyzed by ICP-MS.

The result from the analysis present an interesting trend: it indicates an enrichment of higher volatile elements (Ba, Cs, Pd) collected in the particles with lower AED, on the other hand Zr was collected in the higher concentration on the first stages. Similar behaviour was observed by EDX measurement showing in the smaller particles higher concentration of Cs, I, Ba. Explanation of this phenomenon could be related to different formation mechanisms: while the smaller particles may come from vapour condensation and will be for this enriched in high volatile elements; the bigger may come from liquid particles ejected by mechanic shock, and will so be enriched in the matrix element.

This work is supported by the 7th Framework Program of the European Commission.

Di Lemma F.G., Colle J.Y., Thiele H. and Konings R.J.M. (2012) *Proc. of European Aerosol Conference 2012*, European Aerosol Conference Handbook.