IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

DPAM

Experimental Programmes in the EPICUR Facility

Three themes are studied in the EPICUR facility:

Theme 1 - Iodine under irradiation

The EPICUR programme (physicochemical studies on confined iodine under irradiation) aims at providing experimental data to validate the chemical models for iodine in the reactor containment under accident conditions. These models are integrated into the IODE model of the ASTEC computer code, jointly developed by IRSN and GRS. They are used to predict the behaviour of different types of possible accidents and related releases of radioactive products. This programme will help to better estimate the quantity of radioactive iodine released during a core meltdown accident taken into account when elaborating specific emergency plans. The programme results will also be used to better define the means and measures required to limit releases into the environment.

- About thirty tests were performed by IRSN/ DPAM as part of the International Source Term Programme (ISTP) from 2005 to 2010. These tests aimed at studying the behaviour of iodine in the reactor containment, particularly with the effect of irradiation on:
  - Volatile iodine released from the sump;
  - Organic iodides formed from iodine which are deposited on the painted containment surfaces in air or underwater;
  - Iodide oxides formed from gaseous iodine and their stability.
- About twenty tests are planed to be performed by IRSN/DPAM under the Source Term Evaluation and Mitigation (STEM) programme between 2011 and 2016 as part of an OECD project. This programme will especially focus on the effect of irradiation on:
  - Stability of iodine aerosols (CsI, AgI, iodide oxides, etc.);
  - Interactions between iodine and aged paints in the frame of the reactor life extension;
  - Re-volatilisation of iodine in the long term during an accident.

Figure 1

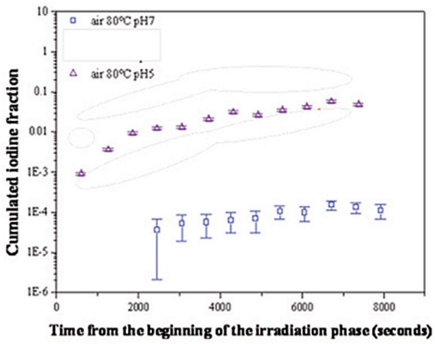

Figure 2

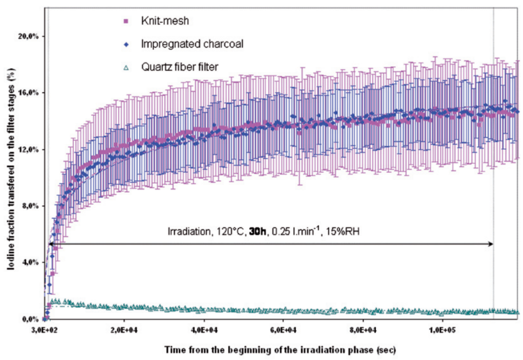

Figure 1:
Change in the total fraction of iodine volatilised from molecular I_2 in solution and then irradiated - T = 80°C.

Figure 2:
Change in the quantities of volatilised iodine in the form of aerosols (quartz filter) molecular iodine (Knit-mesh) and organic iodine (active carbon) formed from molecular I_2 deposited on a painted coupon and then irradiated - T = 120°C, relative moisture content = 15%.

Figure 3:
A glass ampoule device containing either a painted surface coated in ruthenium oxides or an aqueous solution of ruthenium placed in the irradiation tank. Volatilised inactive ruthenium is trapped in the aqueous solution in the lower part of the ampoules and then assayed by ICP-MS after testing.

Theme 2 - Ruthenium under irradiation

A study on ruthenium chemistry – another radiotoxic product – in the reactor containment under accidental conditions was conducted as part of the ISTP. About twenty tests were performed to assess the effect of irradiation on the volatilisation of ruthenium from the sump or deposits on painted containment surfaces. This study provided experimental data used to determine ruthenium quantities released into the environment in the event of an accident.

Figure 3

Theme 3 – Irradiation of materials

Various materials can be irradiated so as to determine the impact of the received dose on the variation in certain properties. This application could be used to study the ageing of polymers, greases and other compounds, which would help improve existing computer models and make it possible to make more informed decisions on the reactor life extension for example.

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