Estimation of hydrogen production rates from radiolysable material in contact with various irradiated fuels.

Abstract:
The storage of irradiated fuel is increasing as many installations are approaching their end-life and fuel or fuel-containing remnants from waste or samples are being placed in storage. Often these smaller experimental samples are mounted in epoxide resins or are placed containers with bitumen. It is particularly in combination with these radiolysable materials where the irradiation generates hydrogen that problems arise in longer term storage. The hydrogen generation results in either pressure build-up (with container bloating & eventual failure) or in case of gas release and mixture with air, a detonation. Previous work [1] has examined the Phébus FPT1 bundle encased in resin where it was necessary for both transport and intermediate storage at Cadarache to assess this risk. This work is a first estimation of the radiolysis rates to be expected from various fuels and to assess the range of H2 production from radiolysable material based on the results of the FPT1 Phébus bundle. The first step is to make a correlation of the total activity (& major isotopes) with the burn-up of various characterised fuels. Allowances for other major factors such as cooling time and linear power need to be considered along with the differences of power reactor type. Then using the H2 production rates measured for the Phébus fuel, an estimate of its dependence on fuel burn-up will be made. The uncertainties associated with this extrapolation will also be evaluated. This estimated correlation could be used to predict approximate hydrogen production rates and so define the necessary ventilation or pressure resistance for the foreseen storage time.

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