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Decay heat and characterisation of spent nuclear fuel for repositories and transport

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For the disposal, intermediate storage and transport of spent nuclear fuel a number of properties of each fuel assembly must be determined, both for operational and safeguards needs. Important examples of these parameters are decay power, multiplicity, burn-up (BU), initial enrichment (IE), cooling time (CT), completeness of fuel assemblies, weight, amount of fissile material and nuclide inventory. This is done through a combination of known fuel history, measurements and codes.
In addition, the status of the fuel assemblies is necessary to characterize. Failed or damaged fuels must be identified prior to final disposal in order to treat them appropriately, as are other mechanical and chemical issues that may affect the handling in the system.
The uncertainties of these determinations are crucial in the use of the parameters, and are judged to be fairly large at present. Particularly the uncertainly of the decay power has a direct relationship to the cost of any repository due to temperature requirements in the systems. These cost savings are potentially very high, in the order of billions of Euros. A thorough understanding of these issues also opens ways to optimize the facilities, for example economically and environmentally.
Due to the large amount of fuel assemblies to be measured, high through-put and robustness of the methods and instruments are paramount, as is the capacity to make fast decisions made on the measurement results and codes.
The status and future needs of development of instruments, basic fuel data and cross sections, and codes will is discussed in the paper, and how this is done in various collaborations world-wide. Potential problems, such as errors in fuel data, uncertainties in basic nuclear data, uncertainty propagation, conflicting methods and results etc., is illustrated and discussed.
An international effort to blindly test the capacity to calculate decay power on fuel history, led by SKB and in collaboration with NEA/OECD –with more than 25 participating organizations and groups, using most of the internationally available codes, is described.

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Country or International Organization

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