# INTELLIGENT NUCLIDE SELECTION CAPABILITY IN THE REACTOR PHYSICS AND INVENTORY CALCULATION CODE SERPENT 2

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*Abstract*

Serpent is a user-friendly reactor physics and inventory calculation code developed at VTT and used by many organizations around the world [1]. Since the neutron transport of Serpent is based on the continuous-energy Monte Carlo method, it is well-capable of calculating the nuclide inventories for all kinds of reactors and fuels – from ordinary LWRs to fast reactors – with high accuracy.

The output of Serpent 2 is versatile, containing for example total and nuclide-wise masses, activities, radiotoxicities and heat productions in the system at each time step. However, the results are only provided for nuclides specifically chosen by the user. For an experienced reactor physicist the nuclides of interest in a problem may be obvious, but a user with less experience might face serious problems when trying to identify the important nuclides in the vast selection.

To further increase the usability of Serpent, a new intelligent nuclide selection capability for the output of Serpent 2 is developed and implemented in the code. The new capability is designed with especially final disposal, transmutation and other fuel cycle -related analyses kept in mind. The new routine selects the output nuclides on basis of their contributions to a user-chosen property. For example, the user may request results for the 10 nuclides with the highest decay heat production. The new version of Serpent also includes a selection of pre-defined nuclide groups for different purposes involving, for instance, the nuclides with a high migration probability and the minor actinides. Also the nuclide list used in COSI6 is included to provide for easy importing of materials from Serpent to COSI6.

This paper describes the implementation of the new nuclide selection capability in Serpent 2. The applicability of Serpent in inventory calculations is also discussed through practical examples.

Reference

[1] Serpent website, http://montecarlo.vtt.fi