Eliminating Nuclear Waste

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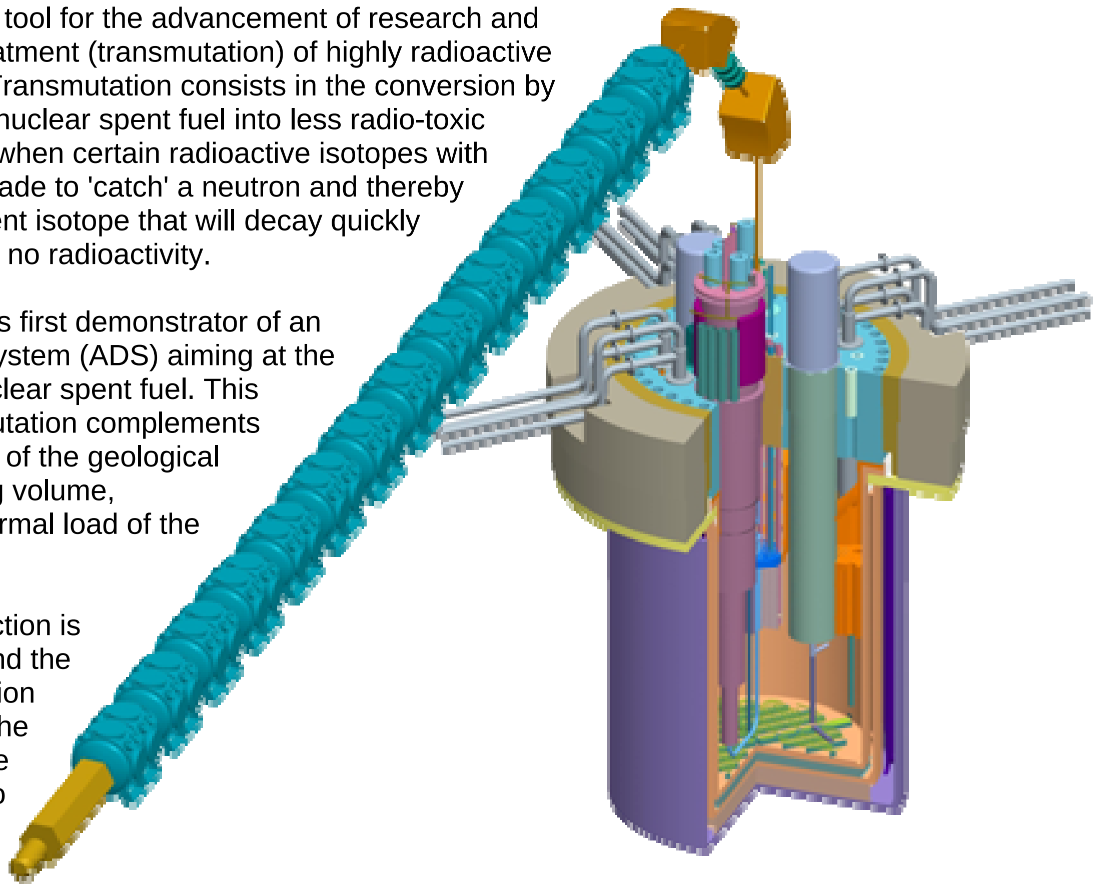
On March 4th the Belgian federal government met the decision to financially support the Multipurpose Hybrid Research Reactor for High-tech Applications (Myrrha) project. The Myrrha project began in 1998 at the Belgian Nuclear Research Centre at Mol, northeast Belgium, and is aimed at the design, construction and operation of an accelerator driven, lead-bismuth-cooled subcritical fast reactor. It will contribute to the development of innovative solutions in the field of nuclear technologies, medical applications, nuclear industry and renewable energy sources.



Myrrha will be a key tool for the advancement of research and development for treatment (transmutation) of highly radioactive nuclear spent fuel. Transmutation consists in the conversion by fission of long-lived nuclear spent fuel into less radio-toxic substances. This is when certain radioactive isotopes with long half lives are made to 'catch' a neutron and thereby change into a different isotope that will decay quickly to a stable form with no radioactivity.

Myhhra is the world's first demonstrator of an accelerator driven system (ADS) aiming at the transmutation of nuclear spent fuel. This research on transmutation complements the decision in favor of the geological disposal by reducing volume, radiotoxicity and thermal load of the nuclear waste.

The start of construction is planned for 2015, and the first phase of operation will begin in 2023. The total budget could be around 1 billion Euro and the project should create about 2000 long-term jobs.

Myhhra would be unique as a sub-critical assembly relying on an accelerator to achieve periods of criticality. It would use a core of 680 kg low-enriched uranium using MOX (U-Pu)O_2 fuel, lead-bismuth as coolant and would develop 57 MW, a similar power to the Halden reactor. The sub-critical core consists of a lattice of 183 hexagonal channels of which, 60 are loaded with fuel assemblies housing the 35% Pu-enriched MOX fuel pins arranged in a triangular lattice. The numerous extra channels allow for flexibility needed to manage MYRRHA as an experimental machine. The accelerator will produce a 600 MeV proton beam and will deposit less than 1 MW energy in the reactor to regulate its operation. Later the accelerator could also be removed for separate use, and the reactor could become a more conventional fast-neutron irradiation facility.

After separation, the accelerator could carry out fundamental physics research and neutron science, with the reactor used in materials research for fusion reactors as well as the doping of silicon and production of medical and industrial radioisotopes. As a lead-bismuth cooled unit, Myrrha would be particularly suited to research into Generation IV designs based on the same coolant.

The facility would also allow the EU and the international nuclear energy community to evaluate and develop some aspects of lead-cooled fast reactors, one of three fast reactor types being considered as part of the Generation IV programme for developing advanced fast reactor systems.

Earlier at the Bergen Computational Physics Laboratory in a large scale EU Research Infrastructure project the burning of the radioactive waste was simulated numerically. This Spring a group of Norwegian researchers with IFE-Halden as coordinator is writing a proposal , “Safety focused Enterprises for Nuclear Sustainable Energy” (SENSE). UiB via the nuclear physicists in the Institute for Physics and Technology is participating in the proposal, aiming for a strengthened role in the upcoming development to make nuclear energy as safe as possible.