

## **Innovative Approaches to the Management of Irradiated Nuclear Graphite Wastes: Addressing the Challenges through International Collaboration with Project ‘GRAPA’**

A.J. Wickham\*

*Nuclear Technology Consultancy, Cwmchwefru, Builth Wells, LD2 3PW, United Kingdom and Visiting Professor, School of Mechanical, Aerospace and Civil Engineering, The University of Manchester, UK*

M. Ojovan and P. O’Sullivan

*Waste Technology Section, Division of Nuclear Fuel Cycle and Waste Technology, Department of Nuclear Energy, IAEA*

### **Abstract**

There exists more than 250,000 tonnes of irradiated (and therefore radioactive) nuclear graphite (“*i-graphite*”) in the world, primarily as a result of the development of graphite-moderated power-reactor systems, initially for defence and subsequently for commercial purposes. Only a very small number of such plants have been dismantled and, for most cases, the final destiny of the irradiated graphite remains unresolved. Future high-temperature reactor programmes, such as the Chinese HTR-PM development, will produce more graphite and carbonaceous wastes from both structural components and the fuel pebbles (which are approximately 96% carbonaceous), the latter producing a continuous stream of so-called ‘operational waste’.

The problem of dismantling irradiated graphite reactor stacks, possibly distorted through neutron damage and in some cases degraded further by radiation-chemical attack by gaseous coolants, and then finding the appropriate treatments and final destiny of the material, has exercised both the European Union and the International Atomic Energy Agency for more than 25 years, seeking to address the different issues and available disposal solutions in different IAEA Member States. An IAEA collaborative research programme on treatment options has recently been completed, and an active group of international specialists in this area has now been established as part of the IAEA International Decommissioning Network under the envelope of Project ‘GRAPA’ (Irradiated **G**raphite **P**rocessing **A**pproaches), which includes representatives from Belgium, China, France, Germany, India, Italy, Lithuania, Rep. of Korea, Romania, Spain, Switzerland, Ukraine and the Russian Federation with direct responsibilities for various parts of the decommissioning and graphite-disposal process in a variety of reactor designs. Interest has also been expressed by colleagues from Sweden and Japan.

Work is in progress on a number of topic areas where weaknesses in the scientific knowledge or the technology have been identified by the decommissioning specialists in individual Member States, together with a number of cross-cutting projects which, it is hoped, will include a practical demonstration of the several stages of removal, treatment and disposal of highly-irradiated graphite from a suitable reactor. The issues of handling irradiated graphite, and the general scope and achievements of the GRAPA project, will be described in this presentation.