NUCLEAR FUEL CYCLE

Regular Budget expenditure: $2 957 904

Expenditure by subprogramme

Raw materials for reactor fuels	*$600 372*
Reactor fuel technology and performance	*$788 155*
Spent fuel management, technology and safety	*$1 154 314*
Information on the nuclear fuel cycle	*$415 063*

Extrabudgetary programme resources utilized (not included in chart): $350 205

Agency activities related to the nuclear fuel cycle concentrate on: the availability and market conditions for uranium resources; fuel technology and performance in reactors; spent fuel management and information systems for fuel cycle facilities; and special nuclear materials. During 1995, comprehensive studies were carried out on the supply and demand for uranium, technology associated with the increased burnup of LWR fuels, safety guidelines for the storage of spent fuel from research reactors, the long term storage of spent fuel, especially under dry conditions and the disposition of plutonium.

Raw Materials for Reactor Fuels

The IAEA–OECD/NEA publication *Uranium 1995 — Resources, Production and Demand* (the 'Red Book'), a standard reference work over the years, has for the first time become a genuinely global report of uranium related activities, with information on 54 countries. The latest edition of this report indicates that while there was no shortage of uranium resources, there was a substantial shortage of production capacity and low cost uranium resources. In 1995, six countries — Australia, Canada, Kazakhstan, Niger, the Russian Federation and Uzbekistan — produced over 70% of the world's total uranium. The 1995 worldwide reactor related requirements were estimated to be about 61 400 tonnes of uranium per year, which was about 29 000 tonnes greater than world uranium production. Thus, only about 53% of the demand was being met by current production. The balance is being filled by inventory drawdown.

Recent changes in the uranium industry were reviewed at a Technical Committee meeting held in Kiev in co-operation with the OECD/NEA. Key issues that were discussed included uranium deposit exploration, exploitation, resources, production and the world supply/ demand relationship. This was the first Agency meeting dealing with these subjects to be held in the Commonwealth of Independent States. Specialists from around the world were able to exchange information at a time of heightened interest in the supply of uranium as a result of predictions of an acute production shortage.

A new map of the world's uranium deposits was published in co-operation with the Geological Survey of Canada. It depicts information on 582 uranium deposits, some of which are active mining operations. The most comprehensive compilation of such data to be published, this map includes previously unavailable information on uranium deposits in eastern Europe, the former USSR and China. A more detailed database on the deposits shown on the map is currently being completed.

Reactor Fuel Technology and Performance

At the second Research Co-ordination meeting of a CRP on stress corrosion cracking of Zircaloy fuel cladding, held in Buenos Aires, data were presented on pre-cracked specimens machined at the host laboratory (AEA Technology, United Kingdom). They were evaluated by the supervisory group (comprising developed countries) and, as a result, the test matrix was modified for the final phase of the CRP. In addition, details of the equipment developed and the procedures to be used in further tests in this CRP were reviewed by the supervisory group, and recommendations for improvements were made.

A Technical Committee meeting on the behaviour of LWR core materials under accident conditions, held in Dimitrovgrad, the Russian Federation, concentrated on the properties of structural and fuel materials and their interaction and behaviour under various accident conditions, including loss of coolant, reactivity insertion and severe accidents. The conclusion was that the available data are not sufficient for high burnup fuel behaviour modelling for either design basis or beyond design basis accidents. However, owing to the complexity and high cost of these experiments, as well as the continuing demand to justify safe high burnup fuel behaviour under accident conditions, international co-operation in this area was viewed as an important complement to national programmes.

Developments in the areas of destructive hot cell examination and fuel rod refabrication techniques were reported by 15 institutes at the final Research Co-ordination meeting of a CRP on examination and documentation methodology for water reactor fuel (ED-WARF-2). This meeting was also held in Dimitrovgrad. As a result of this CRP, a guidebook on destructive examination of water reactor fuel and a catalogue of hot laboratories were completed and will be published in 1996. Together with an earlier published guidebook on the non-destructive examination of water reactor fuel (the result of the ED-WARF-1 CRP), these documents present a complete description of current water reactor fuel post-irradiation examination techniques and their availability worldwide. They will fill a genuine need among fuel designers, vendors and utilities.

Spent Fuel Management, Technology and Safety

An extrabudgetary initiative under the programme on the safety of WWER and RBMK nuclear power plants was initiated in 1995. One of the first activities was the convening of a Technical Committee meeting/workshop on the selection of dry storage technologies. The goal was to provide guidance to experts from eastern European Member States on the methods of selecting interim dry spent fuel storage technologies, and to provide a forum for in-depth discussions on the licensing and safe operation of these facilities. Follow-up activities include the organization of a workshop in 1996 on the licensing and quality assurance of dry storage facilities, as well as new research on the behaviour of spent WWER and RBMK fuel, and the modelling of their physical parameters.

Two international programmes currently dominate activities regarding the management, interim storage and ultimate disposal of spent nuclear fuel from research and test reactors. The first is the Reduced Enrichment for Research and Test Reactors (RERTR) programme, and the second is the proposed take-back of spent research reactor fuel by the country where it was originally enriched. The Agency supported these two efforts in 1995 by co-operating in the convening of the 18th International RERTR Conference in Paris. Other activities focused on obtaining an overview of spent fuel problems at research and test reactors by preparing and maintaining a database. A summary of the database, presented at the 18th RERTR Conference, identified the need for research reactor operators to prepare spent fuel management plans to cover the complete period from reactor core fuel unloading until despatch to a reprocessing facility or to a final repository.

Information on the Nuclear Fuel Cycle

The increasing global inventories of separated civil plutonium are attracting greater international attention and concern. It now appears that plutonium from dismantled nuclear weapons will further increase these inventories. Worldwide estimates of civil separated plutonium were developed and published in the *IAEA Yearbook 1995*. The goal is to produce reliable estimates of present and future inventories of separated civil plutonium, which may then be used to evaluate in an appropriate manner the safety and non-proliferation issues. Such estimates may also provide a foundation on which appropriate plutonium management concepts, including burning and disposal, can be developed.