



## PAST AND FUTURE IAEA SPENT FUEL MANAGEMENT ACTIVITIES

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The main objectives and strategies of the Agency's activities in the area of spent fuel management are to promote the exchange of information between Member States on technical, safety, environmental and economic aspects of spent fuel management technology, including storage, transport and treatment of spent fuel, and to provide assistance to Member States in the planning, implementation and operation of nuclear fuel cycle facilities.

During 1990, 1991 and 1992 a number of international meetings were organized and publications were issued (Appendix A) in accordance with the recommendations made by the Regular Advisory Group at its 1990 and 1991 meetings.

Below are listed the meetings which have been held since the last issue of the Spent Fuel Management Newsletter:

#### 1. **The International Seminar on Spent Fuel Storage - Safety, Engineering, Environmental and Economic Aspects**

This Seminar was organized jointly by the International Atomic Energy Agency and the Nuclear Energy Agency of the OECD and held in Vienna in October 1990. The seminar was attended by more than 100 specialists from 30 countries and 4 international organizations and 36 papers were presented. It provided a forum for exchanging information on the state-of-the art and prospects of spent fuel storage with emphasis on safety, engineering, environmental and economic aspects as well as providing developing countries with the possibility of receiving information on experience and knowledge in this field.

#### 2. **Regular Advisory Group on Spent Fuel Management**

A meeting of the Regular Advisory Group on Spent Fuel Management was held in Vienna in October 1991 to review the world-wide situation of spent fuel management, to define the most important directions of national efforts, and international cooperation in this area, to exchange information on the present status and progress in the performing of the nuclear fuel cycle, and to assist the IAEA to formulate the future programme in the subject field. 16 participants from 11 countries took part in this meeting. The Advisory Group observed that the activities related to the management of spent nuclear fuel continue to be of high priority in assuring the optimum safe use of nuclear energy. It was agreed by the participants that past and current activities of the IAEA have proven very beneficial in assisting countries in matters related to spent fuel management.

**3. Technical Report on Strategies, Options and Trends in Spent Fuel Management**

The Advisory Group Meeting (AGM) held in April 1991, with participants from 17 countries, discussed the plans of the Agency to prepare a Technical Report Series document on spent fuel management. In 1992 consultants from France, Germany, UK and the USA using the data from the AGM prepared the draft of the Technical Report Series (TRS) "Strategies, Options and Trends in Spent Fuel Management". The document presents the options and choices which are available for the management of spent nuclear fuel, and enables Member States to achieve an integrated approach to spent fuel management by addressing the important considerations in a structured manner. The TRS will be finalized in 1993.

**4. Fuel Rod Consolidation**

According to the recommendations made by the Regular Advisory Group on Spent Fuel Management in 1990, the Agency prepared a Technical Document (TECDOC) on "Consolidation of spent fuel rods from LWR". During two consultancies in November 1990 and June 1991 experts from US and Germany reviewed the state-of-the art of rod consolidation, compiled new information on the subject and defined the areas for future developments. The document presents the current status of the process by which Light Water Reactor (LWR) spent fuel is consolidated for the purpose of decreasing the space needed for interim storage and final disposal. The report outlines the major technical and licensing concerns, past and future demonstration of rod consolidation.

**5. Establishment of Database on Spent Fuel Inventories, Projections and Characteristics**

During the Advisory Group Meeting on "Spent Fuel Documentation, Inventories and Projections" in June 1992 participants from 10 countries elaborated a spent fuel management data base and evaluated an adequate set of information parameters to ensure safe and reliable handling of the spent fuel. The Group reviewed status reports from the countries represented, on spent fuel inventories, their projections and related documentation. The Group identified the main categories of data requirements relating to each of the back end stages of the fuel cycle, including handling and transport. An agreed set of data requirements and associated tracking arrangements which were judged to be the minimum necessary to support safe spent fuel management operations were established. The Group recommended that it should be proposed to the Member States, at a national level, to establish and maintain data records on spent fuel according to the format prepared by the IAEA. The preparation of the Technical Document on the subject will be continued in 1993.

**6. Technical Report "Manual on Design, Technology and Operational Experience"**

The main goal of this publication is to provide the specialists with new information and international experience on how to achieve technical requirements for spent fuel storage facilities, examples of methods, how to fulfil technical requirements will be discussed based on experience of different countries. Main principal components of the spent fuel storage facilities will be described separately with detailed explanation. The contents of the document and synopsis of some chapters were prepared during an Advisory Group meeting in 1992, attended by participants from 10 countries. Based on the outcome of this meeting, consultants from France, Russia, UK and the USA prepared the draft of the Technical Report. The TRS will be finalized in 1993.

**7. Coordinated Research Programmes (CRPs) on Behaviour of Spent Fuel and Storage Facility Components During Long Term Storage (BEFAST-II, BEFAST-III)**

The CRP on Behaviour of Spent Fuel and Storage Facility Components During Long Term Storage (BEFAST-II) has been completed. 12 countries with 16 agreements participated in this CRP. The third and final Research Coordination Meeting on BEFAST-II was held in March 1991 in Vienna. Participants from 11 countries took part in this meeting. During the meeting the last draft of the BEFAST-II Final Report was reviewed, the conclusions of the BEFAST-II Programme and eventual proposals for future IAEA activities were prepared. It was agreed by all the participants that it will be useful to initiate a BEFAST-III CRP continuing the activities.

In October 1992 14 participants having contracts with the IAEA, and 3 observers from a total of 12 countries participated in the first Research Coordination Meeting (RCM) of the BEFAST-III CRP, organized by both Atomic Energy of Canada and Ontario Hydro (OH) at OH's Headquarters in Toronto.

The purpose of the first RCM was:

- to report the status of national activities and the results achieved during the first year of the CRP,
- to discuss the subjects to be reported during the next Research Coordination Meetings,
- to finalize the table of contents of the future TECDOC, containing the BEFAST-III final report.

The Coordinated Research Programme is covering the period between 1991 - 95. The final report will be published in 1996.

**8. Irradiated fuel management Advisory Missions (IFMAP)**

A Consultants' Meeting was held to discuss the IAEA programme to initiate irradiated fuel management (IFMAP) services. The goal of the project is to assist the developing countries in questions related to the safe storage and

management of fuel both from research and power reactors. A Pamphlet was prepared to inform the interested Member States about the possibility of having advice on irradiated fuel management in the framework of a Technical Co-operation (TC) project.

At the request of the Hungarian Atomic Energy Commission a team of German, Spanish, US, and IAEA experts went to Hungary to advise the Paks Nuclear Power Plant operators on the methods and available technologies of safe spent fuel storage. The experts provided up-to-date information to the operators and to the representatives of different Regulatory Agencies.

At the request of the Ukrainian State Committee on Nuclear and Radiation Safety, a Fact Finding Mission took place to discuss the problems associated with the management of radioactive wastes and spent fuel in the Ukraine. As a result of the Mission the IAEA has now a clearer view of Ukrainian needs, of the priorities and how to address these issues.

At the request of the Government of Thailand, through its Office of Atomic Energy for Peace, a mission took place to investigate conceptual designs of irradiated fuel storage facilities to meet the needs of the Thai research reactor programme, now and in the future. Several conceptual designs were recommended involving pool storage or dry storage.

## **9. Spent Fuel Storage Safety Series**

According to the Programme and Budget of the IAEA for 1991-92, a Consultants' Meeting and subsequently an Advisory Group Meeting was held in 1990 to prepare and discuss the proposed structure of the Safety Series documents to cover all aspects of the storage of spent nuclear fuel.

It was agreed to prepare the following documents:

- Safety Guide on the Design of Spent Fuel Storage
- Safety Guide on the Operation of Spent Fuel Storage
- Safety Practices on the preparation of Safety Analysis Report for Spent Fuel Storage.

The documents are intended to give guidance on the key safety aspects of the long term, safe storage of spent nuclear fuel. They cover all relevant issues of the design, operation and licensing of interim spent fuel storage facilities. For each of the 3 documents a separate Working Group was formed. Each Group had meetings during 1991 and 1992, and produced a draft of their respective document, which was further discussed during a Technical Committee Meeting in Vienna in November 1992.

The TCM participants reviewed all the 3 prepared drafts. The nature of their comments was mainly editorial. The participants noted, that the contents of the documents are very well founded, and no omissions were found. The general opinion was, that the documents are in an advanced state, and that it does not seem necessary for their completion to have separate meetings for each working group.

The final draft of the documents will be reviewed by the IAEA Safety Series Review Committee, all comments will be incorporated in the text and will be sent out to the participants of a Technical Committee Meeting on Safe Long-term Storage of Spent Fuel. At present that TCM is scheduled for November 30 - December 3 1993, but at a later stage if the preparations are well advanced, the TCM probably can be brought forward.

**10. Technical document "Catalogue of Methods, Tools and Techniques for Recovery from Fuel Damage Events"**

On the basis of the recommendations of an Advisory Group Meeting (AGM on "Main Principles of Safe Management of Severely Damaged Nuclear Fuel and other Accident Generated Waste", 13-16 November 1989), the IAEA initiated a programme in 1990 to collect technical information on special tools and methods to deal with circumstances beyond the normal design basis of fuel damage.

A Questionnaire was sent out to solicit information from the countries and organizations which might have experience in this field. The responses to the Questionnaire were discussed at a consultants meeting and at an Advisory Group Meeting during 1990.

On the basis of this material the TECDOC-627 "Catalogue of Methods, Tools and Techniques for Recovery from Fuel Damage Events" was prepared.

The aim of publishing this document is to disseminate the experience gained in the Member States serving article 5 of the "Convention on Assistance in Case of a Nuclear Accident" and also to fill a potential void in response to fuel damage events of less severe magnitude.

**11. Storage of Spent Fuel from Research and Test Reactors**

Concerns in this area are mounting rapidly because of the refusal of some fuel vendors to take back spent fuel and the expense and added problems of waste disposal associated with commercial fuel reprocessing. Many countries without nuclear power programmes do not have the infrastructure to take back radioactive waste and are faced, at the moment, with only one viable option, i. e., to expand their existing interim storage facility or to build an extra facility. A programme has been started to address these special problems of the storage of irradiated fuels from research and test reactors. The first step, already underway, is to assess the full extent of the problem. Further steps, already planned, involve the initiation of a CRP and a training course on irradiated fuel storage from both power and research reactors.

**12. Separation and Utilization of Caesium and Strontium from High Level Waste**

A status report on the "Feasibility of Separation and Utilization of Caesium and Strontium from High Level Waste" was prepared together with experts

from six countries, namely, Belgium, Germany, Japan, United Kingdom, USA and USSR.

The report is intended as a status report to provide a basis for further consideration of the options for Cs and Sr recovery and for the formulation of appropriate strategies. It examines:

- the present and future market demand for Cs and Sr;
- the technological feasibility of their separation;
- the possible impacts on high level waste management resulting from their separation;
- economic aspects;
- safety, environmental and public acceptability aspects of their utilization.

The document may be of interest to policy makers in the nuclear fuel cycle and in waste management.

### **13. Partitioning and Transmutation (P&T) of Actinides and Selected Fission Products from HLW**

A meeting of the Advisory Group on "Partitioning and Transmutation of Actinides and Selected Fission Products from HLW" was held in October 1991 to review the status of research and development activities, to obtain information of the results of national and international studies on this topic, to define the most important problems in the field of partitioning and transmutation of actinides and fission products in relation to HLW management policy and to provide advice to the Secretariat on possible future IAEA activities in this field which may be better coordinated within the framework of international cooperation. 23 participants from 14 countries and 2 international organizations took part in the meeting. The Advisory Group observed a wide interest among participating countries in the partitioning and transmutation option as a possible complement to the reference scenarios of the back-end of fuel cycle comprising: storage of spent fuel, reprocessing and disposal of vitrified HLW into a deep geological repository. It was agreed that current and future activities of the IAEA could be very beneficial in assisting Member States in matters relating to the partitioning and transmutation programme and information exchange. The Group reviewed and agreed on the proposed 1993/94 programme.

In 1992 the 6 experts from Belgium, France, Japan, Russia and CEC reviewed the status of development in Member States in the field of partitioning and transmutation. It was pointed out that the existence of programmes being implemented by OECD/NEA and CEC led IAEA to establish a complementary programme on the fundamental safety aspects of partitioning and transmutation, that could be beneficial in assisting Member States in their national P&T programmes and fostering the information exchange.

Therefore, it was recommended that IAEA should undertake a study with emphasis on the environmental and non-proliferation implications of P&T. The scope of the CRP, proposed by the IAEA and the programme of the TCM in 1993 were discussed and agreed upon.

#### **14. World Survey of Spent Fuel Treatment**

The Advisory Group Meeting on "Spent Fuel Treatment and Emerging Problems in this Area" in October 1992 was attended by participants from 6 countries. The number of participating Member States was limited, and the AGM was held with the only objective to review the status and trends of spent fuel treatment, because of some concerns from the Member States about this sensitive subject, from the proliferation point of view. Country reports were presented and main areas of current development in spent fuel reprocessing were pointed out. The Advisory Group agreed that the IAEA should keep under review the state of the art in fuel reprocessing. Meetings for the exchange of information are useful, and should be organized at approximately 3-4 years' intervals. The proceedings of the meeting have been published as Working Materials.

#### **15. Irradiation Degradation of Materials in Spent Fuel Storage Facilities**

Degradation of the mechanical and physical properties of ageing materials in ageing irradiated fuel storage facilities, is beginning to raise serious concern. In particular, the lack of understanding of the fundamental mechanisms of a material's response to the corrosive environments found in irradiated fuel storage facilities raises a formidable barrier to the prediction of behaviour over extended time periods. This inability to extrapolate materials' behaviour with any confidence may cause problems with license extension for some facilities. Applications for license extensions well beyond the original design life may be prompted by the decision in some countries to cancel the fuel reprocessing option and delays in the availability of final disposal facilities in almost all countries. To address these concerns the first steps have been taken to set up a CRP on the topic of irradiation degradation of materials in spent fuel storage facilities.

#### **16. Cost Analysis Methodology of Spent Fuel Storage**

The report on "Cost Analysis Methodology of Spent Fuel Storage" was prepared. The reason for this project was that comparisons too often improperly present the relative costs of different spent fuel storage options because an appropriate methodology has not been used. One common error is attempting to compare assessments of different spent fuel management strategies undertaken by different nations where the requirements and circumstances are quite different. This report has been written to inform professionals involved in the development and implementation of policy decisions as well as staff who may be technically aware of, but not experienced in, the details of spent fuel storage. Furthermore, this report should also be useful for experienced nuclear engineers.

Taking into account that spent fuel management will be within the next decade a key issue for the nuclear fuel cycle and an important and common problem for the nuclear community, the Agency plans to continue its efforts in this field. The following meetings are scheduled for 1993:

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| 1. | TCM on Away-from-Reactor Storage Concepts and their Implementation      | March     |
| 2. | TCM/Workshop on Management of Fuel Failure Events                       | September |
| 3. | TCM on Partitioning and Transmutation of Actinides and Fission Products | November  |
| 4. | TCM on Safety Guides for Long Term Storage of Spent Fuel                | November  |
| 5. | AGM on Storage Experience with Fuel from Research Reactors              | May       |
| 6. | AGM on Spent Fuel Management: Current Status and Prospects              | September |

Furthermore, the Agency is considering holding jointly with OECD/NEA a Symposium on Spent Fuel Storage, Safety, Engineering and Environmental Aspects in October 1994.

TCM = Technical Committee Meeting

AGM = Advisory Group Meeting