

IAEA PROGRAM FOR HANDLING, PROCESSING AND STORAGE OF WASTES

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ABSTRACT

The International Atomic Energy Agency's program activities in the field of handling, treatment, conditioning and storage of all levels of radioactive waste are described. The early phases of the program, current emphasis and planned activities in the post-1985 period are presented. Particular attention is given to the mechanisms used by the Agency to carry out its mission to disseminate technical information and support research and development efforts in areas of major interest to Member States of the Agency. Several of the planned Coordinated Research Programs (CRP) are discussed including Member State participation, scope of work planned and the time-frame of the programs. The CRP topics include:

retention of iodine and other airborne radionuclides during abnormal and accident conditions; performance of solidified high-level waste forms and engineered barriers under repository conditions; and evaluation of low- and intermediate-level radioactive solid waste forms and packages.

INTRODUCTION

The International Atomic Energy Agency (IAEA) has an active program in the field of radioactive waste management which is administrated by the Agency's Nuclear Fuel Cycle. The primary mission of the Agency's waste management program is the fostering of the exchange of technical, scientific and regulatory information on the subject to its 112 Member States, considering the needs of both developed and developing nations. International cooperation and exchange of information are performed through Agency-sponsored scientific conferences, technical meetings, research coordination programs and technical assistance programs.

The Agency's waste management program is organized into four subprograms covering (Fig. 1):

- handling, treatment, conditioning and storage of radioactive waste;
- decontamination and decommissioning of nuclear facilities;
- underground disposal of radioactive wastes and management of wastes from uranium mining and milling; and
- environmental aspects of radioactive releases.

As indicated by the title of this paper, I will cover only the activities of the subprogram on handling, treatment, conditioning and storage of wastes focusing on technical meetings held in 1984 and planned for the 1985-86 period. I will also provide the latest information on coordinated research program (CRP) activities under this subprogram, discussing the scope of those programs, participation in the programs by various Member States of the Agency and the end products expected.

SUBPROGRAM ON HANDLING, TREATMENT, CONDITIONING AND STORAGE OF RADIOACTIVE WASTE

Background

The Agency's subprogram for handling, treatment, conditioning and storage of radioactive waste covers

three main elements, namely, low-intermediate-level wastes including wastes from nuclear power plants, high-level/alpha-bearing wastes and gaseous wastes. Activities in these elements have centered on the minimization of the volume of waste quantities generated, collection and control of waste streams at their point of origin, treatment of wastes to reduce their volume or removal of radionuclides and conditioning of the wastes to stable forms and packages. The principal effort of the Agency is the review, collection and dissemination of information through technical publications. Table I provides a summary of the number of documents produced since 1960 from which a distribution profile of the effort placed in each element within the subprogram can be obtained.

The distribution among the subprogram elements is reflected below:

LILW, wastes from nuclear power plants	- 57%
Gaseous waste management	- 26%
Alpha/HLW	- 17%

More than half of the activities of the Agency in this subprogram have been placed on low-intermediate-level wastes and wastes from nuclear power plants over the past 25 years or so reflecting the high interest placed by Member States on the management of waste from nuclear power plants. Of course, future distribution of effort may change depending on the interests of the Member States.

I would now like to cover each element of the Agency's subprogram on handling, treatment, conditioning and storage of waste by providing a review of recent meetings held in 1984 and planned meetings for 1985 and 1986.

Low-Intermediate-Level Wastes and Wastes from Nuclear Power Plants

With the high interest in the management of low-intermediate-level wastes, especially with Member States pursuing nuclear power programs, an extensive program has been carried out in this area. Table II

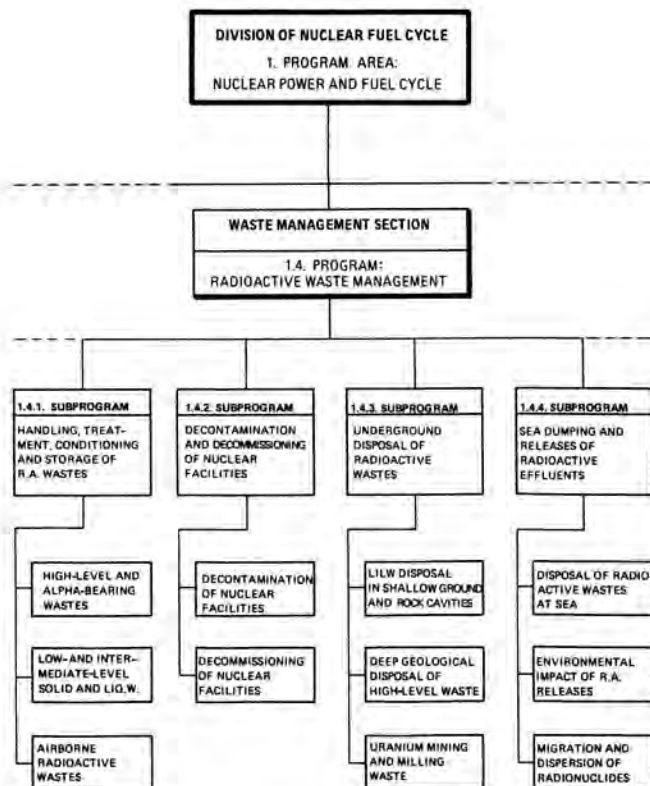


Fig. 1. IAEA Waste Management Program Organization.

TABLE I

IAEA Publications on Handling, Treatment, Conditioning and Storage of Wastes from 1960

Meetings Held in 1984

Design of radioactive waste management systems at NPPs

Techniques and practices for handling, transportation and storage of LIL waste prior to treatment

Meetings Scheduled for 1985/1986

Design of radioactive waste management systems at NPPs - June 1985

Handling and treatment of radioactive waste from unplanned events at NPPs - September 1985

Management options for LIL wastes - October 1985

Immobilization of LIL waste with polymers - 3rd Quarter 1986

Solidification of organic radioactive waste - 4th Quarter 1986.

TABLE II

Activities for LIL Wastes/Wastes From NPPs Program

AREA	TYPE OF DOCUMENT				
	TRS	TECDOC	SS	SP/SR	Total
Low-Intermediate-Level Wastes (LILW), Wastes from Nuclear Power Plants	15	3	2	6	26
Alpha/High-Level Wastes	5	1	-	2	8
Gaseous Waste Management	7	2	-	3	12
TOTAL	27	6	2	11	46

TRS = Technical Reports Series
 TECDOC = Unpriced Technical Document
 SS = Safety Series
 SP/SR = Symposium Proceedings/Special Reports

lists the Agency's activities as accomplished and planned.

Meetings Held in 1984

- Design of radioactive waste management systems at NPPs
- Techniques and practices for handling, transportation and storage of LIL waste prior to treatment

Meetings Scheduled for 1985/1986

- Design of radioactive waste management systems at NPPs - June 1985
- Handling and treatment of radioactive waste from unplanned events at NPPs - September 1985
- Management options for LIL wastes - October 1985
- Immobilization of LIL waste with polymers - 3rd Quarter 1986
- Solidification of organic radioactive waste- 4th Quarter 1986.

Without going into details of every meeting, I should like to point out that, on the average, each of the above technical meetings is attended by approximately 15-20 technical experts representing Member States of the Agency and other international organizations with an interest in radioactive waste management. The end product of the meeting is usually a technical publication which presents the latest "state of the art" information in the field or a Safety Series guide providing recommendations and/or guidelines of a regulatory nature. For example, the meetings planned on the design of radioactive waste management systems at nuclear power plants will result in the publication of an Agency Safety Series document in 1986 which will provide basic criteria, guidance and requirements for Member States on the design of waste management systems at nuclear power plants.

Another meeting listed in Table II that I should like to comment on is the meeting scheduled for 1985 on management options for low-intermediate-level wastes. This meeting is planned as a regional seminar to be held in Lima, Peru, in October 1985 and is classified as a teaching seminar designed especially for the developing nations in the Latin America region. The Agency has twenty Member States in this region involved in varying stages of nuclear energy with different waste management problems. This seminar is intended to provide information and promote the exchange of experience gained in the management of low- and intermediate-level radioactive wastes generated from both non-fuel cycle and fuel cycle activities. The seminar will cover the activities involved in handling, treatment of wastes to reduce volume, conditioning for storage and/or disposal, transportation and disposal. Special emphasis will be placed on selection and combination of the technology options available into an integrated waste management program. I have specifically mentioned this meeting to illustrate another type of exchange forum that the Agency sponsors and to inform attendees of this meeting that the IAEA is seeking invited speakers to participate in this seminar.

Looking beyond 1986, we are aware that close to 400 Gw(e) will be generated from nuclear power by the year 1990. Included in this total is the nuclear power capacity of 15 developing nations that will be operating nuclear power plants by the end of this decade. A major effort of the Agency will likely be

the dissemination of the latest information on the treatment and conditioning of nuclear power plant wastes to Member States with emerging nuclear power programs.

Alpha-Bearing and High-Level Wastes

The Agency's activities in alpha-bearing and high-level waste management have been guided by the interests of Member States with mature nuclear power programs. Efforts have focused on alpha-bearing waste treatment and conditioning, handling and storage of high-level liquid wastes, solidification of high-level wastes and the characterization of solidified high-level waste products. In July 1984, the Agency sponsored a Technical Committee meeting on the management of cladding hulls and fuel hardware. This meeting was attended by experts in this field from seven Member States and one international organization and resulted in the preparation of a draft Agency Technical Reports Series document providing a technical review and the current status of developments in the management of fuel cladding hulls and hardware. This document should be available for distribution in the near future. In 1986, the Agency plans to hold an Advisory Group meeting on the treatment of alpha-bearing wastes. Selected experts from several Member States will be invited to Vienna to discuss the latest technology in this field and to recommend to the agency the need for and direction of further work in this area.

The Agency plans to place additional emphasis on the management of alpha-bearing wastes and high-level wastes by sponsoring several technical meetings in this area in the post-1986 period. Treatment and conditioning technologies for alpha-bearing wastes, technology and environmental factors in comparing spent fuel vs. immobilized waste as a final HLW form, and techniques, testing methods and methodologies for the evaluation of conditioned HLW forms are examples of technical meetings planned in this area.

Gaseous Waste Management

Now, turning to gaseous waste management, this area has been an active part of the Agency's program since the early 1970's with the main emphasis being placed on gaseous waste management at nuclear power plants. Technical meetings and publications of documents on the technologies for retention of iodine and other airborne radionuclides and methods and equipment for testing off-gas and exhaust air cleaning systems have been a major part of the program. In 1984 (Table III), a shift in program emphasis began with a technical meeting on the management of gaseous waste at waste treatment facilities. This meeting concentrated on the design and operational experience with off-gas cleaning systems of various waste incinerators.

Emphasis on gaseous waste technology in nuclear fuel cycle facilities, other than nuclear power plants, will continue in 1985 and 1986. Three technical meetings are planned relating to gaseous waste management at fuel reprocessing and waste conditioning facilities.

Looking beyond 1986, we expect that the major activity will focus on developments in gas and air cleaning systems in nuclear power plants as the state of the art continually improves. New developments in testing and monitoring gas cleaning systems in nuclear facilities will also be observed closely and a technical meeting or seminar will be scheduled to coincide with technology advances in this field.

TABLE III

Activities For Gaseous Waste Management

Meetings Held in 1984

Management of gaseous wastes at waste treatment facilities

Meetings Scheduled for 1985/1986

Conditioning, storage and disposal of Iodine-129 - November 1985

Design and operation of off-gas cleaning systems at waste conditioning facilities - May 1985/September 1986.

Coordinated Research Programs

Up to this point, I have been discussing the Agency's use of technical meetings to disseminate information to its Member States. As mentioned in the Introduction to this paper, the Agency also sponsors Coordinated Research Programs which have the prime objective of fostering cooperation and the exchange of R/D information among Member States that have a common interest in a particular subject. Coordinated Research Programs are normally organized by the Agency with Member States through the execution of research contracts or research agreements on a subject of common interest. Research contracts are provided to developing Member States and differ from research agreements, which are offered to developed Member States, in that a small part of the R/D cost is supported by the Agency in the former case. Coordinated Research Programs usually have from 5 to 10 Member State institutes participating and normally extend over a 4 or 5 year period. Three times during the course of the program, the principal investigators under the program are invited to a research coordination meeting at the Agency's expense. At these meetings, the program of each participant is discussed in terms of content, direction and achievements. Our experience with CRPs shows them to be an extremely effective mechanism for keeping interested Member States well informed in an area of particular interest as well as providing the opportunity for them to receive valuable feedback on their own program efforts from experts of other countries. Under the Agency program for handling, treatment, conditioning and storage of radioactive waste, three Coordinated Research Programs are active or in the final planning stages (Fig. 2).

Retention of gaseous radionuclides during abnormal and accident conditions has raised considerable interest in the international nuclear community. Questions on the behavior of filters and other off-gas cleaning systems under accident conditions have fostered new work in this area. To support this effort and provide for the effective exchange of information among interested Member States, the Agency initiated a CRP in 1983 on the "Retention of Iodine and Other Airborne Radionuclides during Abnormal and Accident Conditions". This CRP is composed of eight Member States and is expected to be active through 1987. The first research coordination meeting under this program was held in Mol, Belgium in September 1984. Work on the testing of off-gas systems during abnormal conditions, including the retention properties of various absorbent materials as affected by age, humidity, face velocity, etc., will be covered during the course of the program.

The CRP on the "Performance of Solidified HLW Forms and Engineered Barriers Under Repository Conditions" has recently been established and is a follow-on program to a recently completed CRP entitled "Evaluation of Solidified High-Level Waste Forms". The first CRP which was completed in 1983 had the primary objectives to review and disseminate information on properties of solidified high-level waste forms, to provide a mechanism for analysis and comparison of results from different institutes and to establish future plans for work in this area. The results of the CRP which was completed in 1983 had the primary objectives to review and disseminate information on properties of solidified high-level waste forms, to provide a mechanism for analysis and comparison of results from different institutes and to establish future plans for work in this area. The results of the CRP are contained in an Agency Technical Reports Series document which should be available for distribution by the end of 1985. The document will be titled "Chemical Durability and Related Properties of Solidified High-Level Waste Forms". As shown in Fig. 2, the new CRP on the performance of solidified HLW forms has now been established. I am pleased to report that ten institutions from nine Member States are participating in this program. The first research coordination meeting is scheduled to take place in Japan in late October 1985 where initial results of work will be presented and plans developed for follow-up meetings. To obtain some understanding of the scope and content of this CRP, the following list presents a few examples of the work planned by the participating institutions:

- properties and performance of HLW glass products and engineered barriers;
- performance of SYNROC under conditions relevant to repository disposal; and
- performance of conditioned spent fuel under repository-relevant conditions.

An interesting point is to recognize that the scope of the CRP covers the evaluation of conditioned spent fuel as well as solidified HLW forms.

The Coordinated Research Program entitled "Evaluation of Low- and Intermediate-Level Solid Waste Forms and Packages" is now in the planning stage. This CRP will be established later this year and we expect institutions from at least eight Member States to participate in this program. The objective of this program is to exchange information and promote new work on the solidification of low- and intermediate-level waste and the evaluation of the resulting waste forms and packages. Types of wastes in the program scope include spent ion-exchange resins, concentrates and sludges from nuclear power plants or other nuclear facilities. The first research coordination meeting under this CRP is planned for late 1986.

CONCLUDING REMARKS

This paper on the IAEA's program on the handling, treatment, conditioning and storage of radioactive waste provides a brief overview of current and planned activities by the Agency in this field. This program is being implemented by the Agency through the contributions and continued support of the Member States and in close cooperation with other international organizations involved in radioactive waste management. The Agency's efforts to maintain an effective international forum for the exchange and dissemination of information on the management of radioactive wastes depend on its receiving the

On-going or Planned CRPs	MEMBER STATES INVOLVED	1984	1985	1986	1987	1988	1989	1990
1. Retention of iodine and other airborne radio-nuclides during abnormal and accident conditions	Austria, Belgium, FRG, GDR, Hungary, India, Republic of Korea, Yugoslavia	RCM		RCM	RCM	P		
2. Performance of solidified HLW forms and engineered barriers under repository conditions	Australia, Belgium, Canada, FRG, Japan, India, Sweden, UK, USA	PE	RCM		RCM	RCM	P	
3. Evaluation of low- and intermediate-level solid waste forms and packages	To be determined: 8-10 Member States		PE	RCM		RCM	RCM	P

KEY PE = Program Established
 RCM = Research Coordination Meeting
 P = Publication

Fig. 2. Coordinated Research Programs.

necessary input from Member States as to how best to employ its resources. I invite any comments or

suggestions that this audience may wish to offer with regard to the Agency's program as presented.