



# Overview of IAEA activities in the field

*The programme structure incorporates some new elements*

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Since the IAEA's inception in 1957, radioactive waste management has been an important programme element because of its impact on the development and use of nuclear energy. Over the last three decades the programme emphasis has varied according to the actual needs of nuclear energy's technological development.

Agency programmes, which are prepared for several years in advance in consultation with appropriate organizations and experts of Member States, also are reviewed by competent forums.\* Care is always taken during programme preparation so that a proper balance is maintained between the activities related to the interests of both developed and developing countries.

The current waste management programme is structured to cover the following important areas:

- Handling, treatment, conditioning, and storage of radioactive waste
- Decontamination and decommissioning of nuclear facilities
- Underground disposal of radioactive waste
- Sea dumping and environmental consequences of radionuclide releases.

### Valuable results obtained

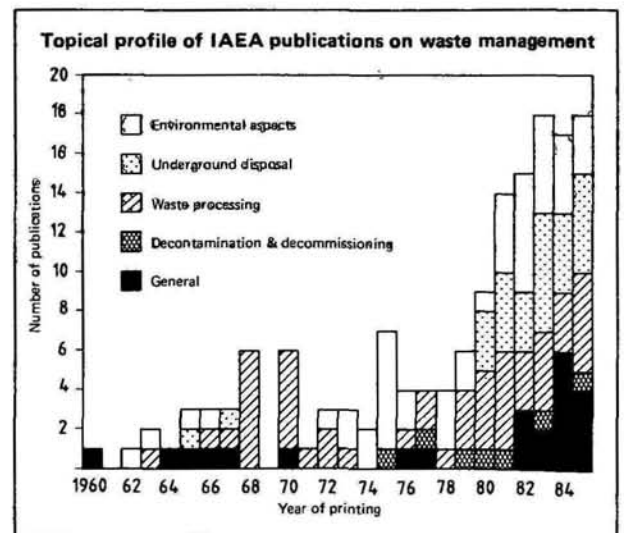
Due to increasing interest of Member States, the Agency has enhanced efforts to assist them in developing and implementing national waste management programmes. Substantial results have been obtained in two areas:

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\* For example, the Senior Advisory Group to Review the IAEA's Waste Management Programme; the Technical Review Committee on Underground Disposal; and the Scientific Advisory Committee of the IAEA.

• *Dissemination of up-to-date technical and scientific information.* A review of Agency waste management publications indicates that in the 1960s the preparation of basic safety reports (e.g., sea and fresh water disposal of wastes) and technical reports on waste management technologies (e.g., evaporation, ion-exchange, chemical treatment, air-filtration) received priority. In the next decade, the 1970s, emphasis shifted — as a result of impetus from the UN Conference on Human Environment held in Stockholm in 1972 — to the development and elaboration of safety guidelines concerning the environmental dispersion of radioactive wastes. Thus, most reports and proceedings published during the period were concerned with environmental protection aspects of peaceful uses of nuclear energy.

In the current phase, since 1980, a significant part of the publications have dealt with underground disposal of



radioactive waste within the framework of the integrated underground disposal programme initiated in 1977. All documents relevant to disposal of low- and intermediate-level wastes (LILW) into shallow land or rock cavities have been issued. (See the accompanying chart for an overview of the distribution of reports since 1960.)

More than half of the Agency reports have been issued during the past 5 years, an important aspect indicating they contain the most up-to-date information available in a continually evolving and rapidly developing field.

• *Technical assistance for developing countries.* This other main area of the waste management programme is growing rather dynamically and includes various activities. Co-ordinated Research Programmes (CRPs) encourage and assist research in the field. During the past decade, 10 CRPs have been successfully completed. In addition, five are in progress and two are in preparation. There has been broad participation by both developed countries (through research agreements) and developing Member States (through research contracts). (Programme results primarily are published in IAEA's Technical Reports Series.)

Institutional training on waste management has been provided by organizing three study tours (1969, 1979, 1982), three training courses (1982, 1983, 1985), and three seminars (1982, 1983, 1984). Additional training courses and seminars now are in preparation.

Providing assistance for Member States through technical co-operation projects has a high priority in the waste management programme. The demands for assistance take the form of selecting experts, consultants, and visiting professors; appraising fellowship requests; and selecting equipment and supplies. Preparation and implementation of 17 projects now is in progress.

In years ahead, technical assistance will receive a higher priority in the waste management programme. An integrated Waste Management Advisory Programme (WAMAP) is being planned to extend the scope of IAEA services. (See accompanying box.)

### Future programme, current structure

For the next few years, the Agency's waste management programme will focus on studying more comprehensive problems in a wider scope and in an overall integrated system basis. The programme is structured under three major areas of activity:

- Handling, treatment, conditioning, and storage of waste
- Disposal of radioactive waste
- Decommissioning of nuclear facilities.

The new programme structure will provide continuity, even though some activities have been terminated (e.g., disposal into shallow land). However, the programme incorporates some new elements – for example, the waste management advisory service, public understanding efforts, and exemption levels for disposal.

Following are highlights of programme components and elements.

### Waste management processes, procedures

The handling, treatment, conditioning, and storage of radioactive waste has been a programme activity since the inception of the Agency. Member States having even a modest nuclear application programme are faced with the problem of radioactive waste generation. Therefore, development and implementation of processes to reduce waste volumes and produce immobilized waste forms for safe containment is a fundamental requirement to the continual use and growth of nuclear energy.

### Technical assistance for developing countries

Technical assistance for the Agency's developing Member States is a problem of high priority in the waste management programme. To extend the range of Agency services, a Waste Management Advisory Programme (WAMAP) soon will be launched to enable developing countries to take practical steps for implementing integrated actions in this field. In particular, advisory programme teams would:

- Advise and assist in the preparation or review of national or regional waste management programmes, so as to optimize radioactive waste management programmes on an overall system basis
- Assist on any particular component of the waste management system, and in particular in the preparation of national standards, criteria, and regulations on radioactive waste management; in the preparation of pre- and post-operational impact assessments for radioactive waste disposal systems; on institutional controls and environmental surveillance programmes for radioactive waste management repositories; and on safety analysis and assessments
- Advise on the purchase of Agency-financed equipment/laboratory ware and instruments and on the sharing of costly equipment and instruments for certain investigations of common interest
- Advise and assist in the training and development of expertise in the various fields of radioactive waste management
- Participate in seminars and lectures convened during the visit of the mission to Member States.

In addition, advisory teams would look into the possibility of sharing expertise, engineering know-how, and laboratory facilities.

### Equipment and instrumentation

will be aspects of advisory teams' work. (Credit: B&W)



Several elements fall under this component:

- *Processing of low- and intermediate-level waste (LILW).* Special emphasis continues to be placed on waste generated from the operation of nuclear power plants. In 1986, a regional seminar on waste management options for developing countries will be held.\* Scheduled for 1988 is a symposium on LILW management. Also being prepared are two safety guides on the design of waste management facilities for nuclear power plants, and on the design and operation of waste incinerators. These will be supporting documents to the Code of Practice on management of radioactive wastes from nuclear power plants.

Several technical reports on handling and processing of radioactive waste at nuclear power plants – including waste volume reduction and waste immobilization technologies – will be issued as well. Research also will be supported through two CRPs dealing with performance of solidified low-level waste forms and the use of inorganic sorbent for liquid waste treatment and repository backfill applications.

- *Processing of high-level and alpha-bearing waste.* In this area, technical reports will be prepared, for example, on the evaluation of technology and safety factors for final waste forms; design and operation of high-level waste (HLW) vitrification and storage facilities; conditioning of alpha-bearing waste, and solidification of organic radioactive waste. Research also will be co-ordinated on the performance of solidified HLW forms and engineered barriers under repository conditions.

- *Management of gaseous waste.* In this particular field, a waste processing technology for off-gas cleaning problems of nuclear facilities during abnormal and accident conditions will receive special attention. Several technical reports will be distributed on design and operation of off-gas and air-cleaning systems at nuclear power plants; handling and retention of airborne radionuclides at nuclear power plants during abnormal operations; and treatment of off-gases at various waste management facilities (e.g., waste incinerators, vitrification facilities, LILW conditioning facilities). Attention also will be paid to development of ventilation and air-cleaning systems of non-fuel cycle facilities, and particular filters. In addition, co-ordinated research is continuing on retention of iodine and other airborne radionuclides during abnormal and accident conditions.

### Disposal of radioactive waste

This area of activity now includes components concerning underground disposal, sea disposal, and radionuclide releases, since assessment of their environmental impact is very similar. Also, the application of the concept of “dose upper-bounds” for these sources needs to be considered in a combined manner.

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\* “Seminar on Management Options for Low- and Intermediate-Level Wastes in Latin America”, currently scheduled for 13–17 October 1986 in Brazil.

- *Underground disposal of radioactive waste.* In this area, regulatory guidelines, standards, codes, and criteria will be developed on the disposal of HLW in deep geological formations. A planned symposium in March 1986 in Hannover, Federal Republic of Germany, will review factors related to siting, design, and construction of underground repositories. Approximately 50 papers are to be presented in sessions covering technical, regulatory, and safety aspects of all types of wastes disposed of in shallow land, rock cavities, or deep geological formations. Apart from the symposium, technical reports will be developed on technological and engineering aspects of siting, design, construction, operation, shutdown, and sealing of deep geological repositories.

In a joint activity with the Agency’s radiation protection section, it is planned to establish the principles and practices for exempting sources of radiation from regulatory control (formerly known as the “de minimis” concept). Guidance will be given on assessment techniques to use in deriving exempted quantities of radionuclides in various applications (e.g., low-level terrestrial and marine environments, the decommissioning of nuclear sites, and recycling of slightly contaminated materials).

- *Sea disposal.* Activities here will be carried out by both the IAEA’s waste management section in Vienna and IAEA’s International Laboratory of Marine Radioactivity in Monaco. (See a related article on the laboratory’s work in this issue.) A primary task for the waste management section is to keep under continuing review the Agency’s definition of waste that is unsuitable for sea dumping, and the recommendations for handling other wastes under the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (commonly known as the London Dumping Convention).

The section also contributes to inter-agency activities relating to the environmental impact of radionuclides in the marine environment. The last revision of the definition and recommendations took place recently, and the next revision is expected in 7 to 10 years. In the interim, technical reports will be prepared on setting dose upper-bounds; the application of exemption rules to disposal of radioactive waste into coastal and shelf waters; the evaluation of the impact of dumping on deep-sea organisms; and the compilation of an updated data base for modelling.

- *Environmental safety assessment.* This is concerned with the need to evaluate the impact of releases of radioactive materials from waste management practices on man and his environment. Emphasis is placed on providing guidance on assessment techniques and on encouraging research aimed at obtaining the required environmental transfer data for improving the reliability of model predictions. Of particular importance is the development of methods for demonstrating the long-term safety of radioactive waste disposal.

Guidance will be provided on methods for assessing the reliability of environmental transfer model predictions, and this theme will be continued in a co-operative





To share experience in waste management, IAEA is holding a regional seminar later this year in Latin America. (Credit: AIF)

activity of the Agency, the Commission of the European Communities (CEC), and the International Union of Radioecologists (IUR). They are jointly organizing a seminar on environmental transfer model reliability in 1987. Separately, technical reports will be prepared on a review of atmospheric dispersion models; the assessment of the environmental transfer of radionuclides in non-temperate environments; and an international compilation of environmental transfer data.

The impact of waste disposal on the natural environment is being studied by reviewing information on the effect of radiation on ecosystems. In the field of environmental migration studies, two CRPs have recently been concluded, one on the role of sediments in the transport and accumulation of radioactive pollutants in rivers and estuaries, and the other on the environmental migration of radium and other contaminants in waste from uranium mining and milling. As a follow-up activity to the latter CRP, a monograph on environmental behaviour of radium will be prepared with contributions from more than 50 experts in the field worldwide.

Related to the safety assessment of underground repositories, a CRP has been initiated on the subject of migration and biological transfer of radionuclides from the shallow land burial of radioactive waste. In 1986,

a study will be initiated on the use of natural analogues related to the safety assessment of geological disposal of HLW.

Towards achieving improved public understanding and acceptance, information that is both technically accurate and readily understandable will be provided regarding established methods for radioactive waste disposal.

#### **Decommissioning of nuclear facilities**

The decontamination and decommissioning of nuclear facilities is of great interest to Member States because several hundreds of nuclear facilities will be decommissioned in the next two decades and many uranium and thorium mine sites and tailing piles will have to be stabilized and/or rehabilitated.

The Agency's programme will include issuance of technical reports on methods of reducing occupational exposures during the decommissioning process, as well as preparation of other safety and regulatory documents. Various technological aspects of decommissioning techniques — for example, decontamination and demolition of concrete and steel structures; use of robotics in decommissioning; methodology and technology of decommissioning; and decontamination — will be

covered by the programme. Also in progress is a co-ordinated research programme.\*

In the area of uranium and thorium mining and milling, a Code of Practice will be issued soon on management of

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\* For a full report on the Agency's decommissioning and decontamination programme, and of related developments in the field, see the *IAEA Bulletin*, Vol. 27, No. 4 (Winter 1985).

waste produced from these sources. Technical reports will be prepared on design of impoundment and disposal facilities for tailings; conditioning of tailings for disposal; and the methodology and technology used in the stabilization and rehabilitation of tailing piles. Also, factors relevant to the decommissioning of facilities, mines, and sites, as well as to waste management from such operations, will be reviewed.

### Technical reading

More technical and detailed aspects of radioactive waste management can be found in Agency publications covering a wide range of activities. A selective listing of recent sales publications:\*

- *Radioactive Waste Management, proceedings* (in five volumes) of an international conference co-sponsored by IAEA and the US Department of Energy in 1983 at Seattle, Washington, STI/PUB/649 (1984).
- *Concepts and Examples of Safety Analyses for Radioactive Waste Repositories in Continental Geological Formations*, Safety Series No. 58, STI/PUB/632 (1983).
- *Conditioning of Low- and Intermediate-Level Radioactive Wastes*, Technical Reports Series No. 222 STI/DOC/10/222 (1983).
- *Conditioning of Radioactive Wastes for Storage and Disposal*, proceedings of an international symposium jointly sponsored by IAEA, the Commission of the European Communities, and the OECD Nuclear Energy Agency in 1982 at Utrecht, Netherlands, STI/PUB/624 (1983).

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\* See *Keep abreast* section for ordering information. For a more complete listing, consult the IAEA's *Publications Catalogue* (1985), available from the Division of Publications.

- *Control of Radioactive Waste Disposal into the Marine Environment*, Safety Series No. 61, STI/PUB/609 (1983).
- *Control of Semivolatile Radionuclides in Gaseous Effluents at Nuclear Facilities*, Technical Reports Series No. 220, STI/DOC/10/220 (1982).
- *Criteria for Underground Disposal of Solid Radioactive Wastes*, Safety Series No. 60, STI/PUB/612 (1983).
- *Disposal of Low- and Intermediate-Level Solid Radioactive Wastes in Rock Cavities – A Guidebook*, Safety Series No. 59, STI/PUB/610 (1983).
- *Environmental Assessment Methodologies for Sea Dumping of Radioactive Wastes*, Safety Series No. 65, STI/PUB/681 (1984).
- *Handling and Storage of Conditioned High-Level Wastes*, Technical Reports Series No. 229, STI/DOC/10/229 (1983).
- *Management of Tritium at Nuclear Facilities*, Technical Reports Series No. 234, STI/DOC/10/234 (1984).
- *Management of Wastes from Uranium Mining and Milling*, proceedings of an international symposium organized by IAEA with the OECD Nuclear Energy Agency in 1982 at Albuquerque, New Mexico, STI/PUB/622 (1982).
- *Site Investigations for Repositories for Solid Radioactive Wastes in Deep Continental Geological Formations*, Technical Reports Series No. 215, STI/DOC/10/215 (1982).

