

IAEA Activities on Decommissioning

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Abstract

This paper presents a summary of IAEA activities concerned with the decommissioning of research reactors and nuclear facilities in general. These activities are undertaken in line with IAEA’s role in establishing safety standards for health and environmental protection, including associated legal and policy frameworks, and in fostering the exchange of scientific and technical information relating to current good practice in this field. The role and activities of the International Decommissioning Network (IDN) are described, including related activities undertaken as part of the IAEA’s Technical Cooperation Programme and its Nuclear Safety Action Plan established following the 2011 accident at Fukushima. Recently established IAEA peer review services on decommissioning – part of the Artemis review service - are also described.

Keywords

IAEA, decommissioning, IDN, Artemis, peer review

1. Introduction

In accordance with Article III of its founding Statute [1], the IAEA has various responsibilities that are relevant to the decommissioning of nuclear installations. Specifically, the Agency is authorized:

- To make provision for materials, services, equipment and facilities to meet the needs of research on, and practical development and practical application of atomic energy for peaceful purposes (Para. III-A.2);
- To foster the exchange of scientific and technical information on peaceful uses of atomic energy (Para. III-A.3);
- To encourage the exchange and training of scientists and experts in the field of peaceful uses of atomic energy (Para. III-A.4);
- To establish or adopt standards of safety for protection of health and minimization of

danger to life and property, and to provide for the application of these standards to its own operation as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision (Para. III-A.6).

Decommissioning issues are addressed as part of the Agency’s work concerned with the safe management of radioactive waste. In terms of the IAEA organizational structure, these activities are largely addressed by the Waste Technology Section (WTS), part of the Department of Nuclear Energy, and the Waste and Environmental Safety Section (WES), which is part of the Department of Nuclear Safety and Security. The development of nuclear safety standards is a key responsibility of the latter Department, whereas the major focus of the Nuclear Energy Department is on technology-related issues. Where direct assistance is given to Member States, e.g. in terms of training activities and the provision of services and/or equipment relating to decommissioning, this activity is typically managed by the Technical Cooperation Department, working in collaboration with the other two Departments.

2. Global safety regime for decommissioning

Safety in the course of decommissioning is achieved by ensuring that work is undertaken in compliance with safety standards established and overseen by an independent regulatory authority. To assist national authorities in the development of appropriate standards IAEA has systematically been working on the establishment of a global safety regime in the

field of decommissioning. Relevant policy-level objectives for many Member States are established by the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the “Joint Convention”) [2], which entered into force in June 2001. Its objective is to achieve and maintain a high level of safety worldwide in spent fuel and radioactive waste management. Maintaining and demonstrating safety is required in order to provide for protection of the workers, the public and the environment both during and after completion of decommissioning and following release of the facility or site from the regulatory control. This principle applies to all nuclear licensed facilities and is reflected in Article 26 of the Joint Convention.

The IAEA Safety Standards provide requirements and guidance relating to nuclear safety, radiation safety, waste safety and transport safety. The standards reflect international consensus on the level of safety needed to protect people and the environment from the ionizing radiation and are revised on the regular basis to incorporate new knowledge, experiences and good practices. They are not mandatory on Member States but national legal frameworks are generally in good agreement with the requirements of the standards.

The Safety Standards are organized in a hierarchical structure with a single ‘Safety Fundamentals’ document [3] (SF-1, *Fundamental Safety Principles*) at the top of the hierarchy which lays down ten fundamental safety principles. The ‘General’ and ‘Specific’ Safety Requirements are placed at the next level of the hierarchy and, at the lowest level, are Safety Guides that provide recommendations on how the Safety Requirements could be achieved.

Safety Requirements for Decommissioning are provided in ‘General Safety Requirements Part 6 – Decommissioning of Facilities’ [4]. The associated standards for the protection of workers, the public and the environment are provided in ‘General Safety Requirements Part 3 - Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards’ [5]. The latter document also provides radionuclide-specific levels for exemption and clearance of bulk amounts of solid material without further consideration. Associated

Safety Guides address the decommissioning of nuclear and research reactors, nuclear fuel cycle facilities and medical, industrial and research facilities [6-11]:

- Safety Guide on Decommissioning of Nuclear Power Plants and Research Reactors WS-G-2.1
- Safety Guide on Decommissioning of Medical, Industrial and Research Facilities WS-G-2.2
- Safety Guide on Decommissioning of Nuclear Fuel Cycle Facilities WS-G-2.4
- Safety Guide on Release of Sites from Regulatory Control on Termination of Practices WS-G-5.1
- Safety Guide on Safety Assessment for the Decommissioning of Facilities Using Radioactive Material WS-G-5.2
- Safety Guide on Application of the Concepts of Exemption, Exclusion and Clearance, RS-G-1.7.

The first three guides (above), published from 1999 to 2001, are currently under revision in line with the Safety Fundamentals [3], with the recently published Decommissioning Safety Requirements [4] and International Basic Safety Standards [5], and to reflect experiences and good practices accumulated during the last 10 years.

3. The International Decommissioning Network (IDN)

The IDN was launched in 2007 as a forum to bring together existing decommissioning initiatives both inside and outside the IAEA to enhance cooperation and coordination. Its detailed objectives include facilitating direct exchange of information between practitioners and promoting the application of good practice in decommissioning technology, planning, project management, and the management of nuclear wastes. The main participating organizations - which include implementers, regulators, research organizations and waste management organizations - meet once each year at the IDN Forum. This meeting takes place over three days and provides different opportunities for sharing of information between the participants, including specific events aimed at promoting networking.

There are currently two collaborative projects taking place with involvement of the membership of the IDN - DRiMa (risk management in

decommissioning) and DACCORD (cost estimation for decommissioning of research reactors). The DACCORD project utilizes a software tool (CERREX) that has recently been developed by the Agency to facilitate cost estimation of decommissioning of research reactors. Both projects are scheduled for completion during 2015.

The IDN is also instrumental in organizing training activities and workshops aimed at competence building in connection with the planning and implementation of decommissioning. These activities, which are implemented in close collaboration with the IAEA's Technical Collaboration Department, have recently included training events were organized on a wide range of issues, including: safety assessment of sites for decommissioning and remediation (Argonne); decommissioning of Soviet-type research reactors (Romania); environmental impact assessment for decommissioning (European Commission Joint Research Centre, Ispra, Italy); technology selection for decommissioning (Germany); use of engineered barriers in environmental remediation works (Vienna); and radiological characterization and activation calculations for decommissioning (Lithuania).

Communications between IDN members is facilitated by the use the 'CONNECT' communication platform. CONNECT has provisions for data storage and file sharing, discussion forums and access to electronic learning materials related to decommissioning. The platform is also used by other radioactive waste management networks established by the Agency, such that information may also be shared by others whose interests may overlap with those directly involved in decommissioning.

4. Technical cooperation and other international projects

The IAEA provides direct assistance to certain Member States on decommissioning-related issues through its technical cooperation (TC) programme. TC projects may be organized on a national, regional or interregional basis. Using this mechanism the Agency aims to build competence in the concerned countries by facilitating training activities for personnel, including fellowships, by sending expert missions to give advice on current good practice and, in limited cases, by provision of equip-

ment in situations where the recipient would otherwise not have sufficient means to procure vital technologies for undertaking decommissioning. In practice technical cooperation activities are focussed mainly on the needs and priorities of less developed countries.

Ongoing regional and inter-regional projects in the field of decommissioning for period from 2012 to 2015 include:

- RER/9/120 'Supporting decommissioning implementation for facilities using radioactive material'
- INT/9/175 'Promoting safe and efficient clean-up of radioactively contaminated facilities and sites'
- RER/9/106 'Supporting decommissioning and waste management for the Chernobyl, Ignalina and Bohunice A-1 NPPs'.

Since 2005 there have been more than 20 national TC projects focussed on planning and implementation of decommissioning of research reactors and NPPs. Current ongoing national TC projects with specific relevance to the decommissioning of research reactors include:

- INS/9/024 'Preparing a Decommissioning Plan for the Bandung TRIGA-2000 Reactor (Bandung, Indonesia)'
- ZAI/10/04 'Formulating and Consolidating the Decommissioning Process of the Research Reactor Facilities of CREN-K (Kinsasha) while Ensuring Safety in Accordance with IAEA Safety Standards'

A special assistance project for the decommissioning of the Iraqi research facilities damaged during the recent military conflicts in that country has been underway since 2006. Most of these sites have some degree of contamination and require decommissioning and remediation in order to ensure radiological safety.

The assistance project includes the provision of expert advice relating to:

- the development of the legal framework for regulation;
- prioritization of the decommissioning programme; and
- developing decommissioning plans for multiple high risk facilities and sites, particularly at Tammuz and at Al-Tuwaitha.

Phase I of the Iraq project was concluded in 2013. This phase was focused on establishing

regulatory and technical infrastructure for safe decommissioning, building capacities, preparing strategies and plans and supporting implementation of field activities in lower risk environments in order to develop appropriate skills among the workforce. Discussions are ongoing on activities that may be supported during Phase II.

In response to the nuclear accident in March 2011 at the Fukushima Daiichi nuclear power plant in Japan, the IAEA Board of Governors agreed a significant programme of work – the Nuclear Safety Action Plan – aimed at addressing issues raised by the accident. As part of this plan the IAEA Secretariat organized an International Experts’ Meeting (IEM) on ‘Decommissioning and Remediation after a Nuclear Accident’ in January 2013. Lessons for the international community on decommissioning and remediation following a nuclear accident were subsequently published [12, 13]. In 2013 the IAEA performed a peer review of the decommissioning ‘roadmap’ being implemented by the Japanese authorities. A new international project will be launched by IAEA in January 2015 on ‘Management Decommissioning and Remediation of Damaged Authorized Facilities’.

5. International peer review activities

IAEA has recently launched a new integrated expert peer review service for radioactive waste and spent fuel management, decommissioning and remediation programmes, known as ‘Artemis’. Artemis reviews, which are based on IAEA safety standards and technical guidance, as well as on international good practices, are available for Member State organizations, facilities and activities involving radioactive waste or spent fuel management, radiological impact assessments for human health and the environment, the management of residues arising from uranium production as well as the decommissioning and remediation of sites contaminated by radioactive materials. The scope of ARTEMIS reviews vary according to the needs of the requesting organization or facility, spanning national frameworks, regulatory systems and specific aspects of national programmes. Reviews may also involve detailed assessments and technical advice on the implementation of specific programmes and project activities, with an emphasis on technology, on safety, or both. Examples of

reviews conducted by the IAEA in recent years include:

- International Peer Review of the decommissioning of some of the MAGNOX facilities at Bradwell site, UK
- International Peer Review of the BN-350 Nuclear Power Plant Decommissioning Plan, Kazakhstan
- Selection of the Decommissioning Strategy for the Ignalina Nuclear Power Plant, Lithuania
- Safety review of the operational NPPs in Ukraine (Joint Ukraine-EC-IAEA Project, Task 3 – Waste Management and Decommissioning)
- Expert review of the Preliminary Decommissioning Plan and the Decommissioning Cost Estimate for the Cernavoda NPP Units 1 and 2 (part of the IAEA TC programme)
- Expert review of the Decommissioning Plan for the Armenian NPP (part of the IAEA TC programme)

6. Recent publications on decommissioning

More than sixty publications (NE Series Reports, Technical Series Reports, Safety Standards, Safety Reports, TECDOCs etc.) have been published by the IAEA in the field of decommissioning. These cover a very wide range of safety and technological issues, including guidance documents on the safe implementation of decommissioning and the release of sites and materials from regulatory control, as well as on technologies for measuring levels of radioactivity and for decontamination and dismantling of plant and structures, and on non-technological aspects such as planning, cost estimation and project management.

Recent technical publications in the field of decommissioning include:

- Policies and Strategies for the Decommissioning of Nuclear and Radiological Facilities, IAEA Nuclear Energy Series NW-G-2.1, 2012
- International Structure for Decommissioning Costing (ISDC) of Nuclear Installations. Prepared in cooperation with OECD-Nuclear Energy Agency and EC, published by OECD (Paris), 2012
- Cost Estimation for Research Reactor Decommissioning, IAEA Nuclear Energy Series Report NW-T-2.4, 2013

- Experiences and Lessons Learned Worldwide in the Cleanup and Decommissioning of Nuclear Facilities after an Accident, IAEA Nuclear Energy Series Report NW-T-2.7, 2014.

Recent safety-related reports relevant to decommissioning include:

- Monitoring for Compliance with Exemption and Clearance Levels, Safety Reports Series No. 67, 2012
- Monitoring for Compliance with Remediation Criteria for Sites, Safety Reports Series No. 72, 2012;
- Safety Assessment for Decommissioning - Outcomes of the International Project on Evaluation and Demonstration of Safety for Decommissioning of Facilities Using Radioactive Material (DeSa), Safety Reports Series No. 77, 2013.

7. CONCLUSIONS

The Agency uses many different mechanisms to foster the exchange of scientific and technical information relating to decommissioning, including the establishment of databases with information on the global status of decommissioning programmes. In recent decades it has published a wide range of reports of technical aspects of decommissioning and remediation. These aim to document good international practice and are intended to complement the safety standards and their associated guidance documents.

An important recent development has been the establishment of networks of organizations working in decommissioning and environmental remediation, including both implementing organizations and regulators. The International Decommissioning Network (IDN) has been in existence since 2007 and Environet, concerned with remediation, has been in operation since 2009.

It is evident that decommissioning projects will continue to be undertaken for many decades, over which time significant technological developments will occur. It will be important that the new technologies of the future are applied to these activities. The Agency has an ongoing role over this period in assisting Member States in finding solutions to those issues that prevent progress being made in mo-

ving ahead with the cleanup of nuclear sites in an environmentally responsible manner and in ensuring that mechanisms are in place to foster the sharing of experiences between different programmes.

In so far as decommissioning programmes are hampered by inadequate legal and regulatory frameworks or by lack of appropriate expertise, the Agency will continue to give direct assistance to Member States subject to the prioritization of its available resources. It will also continue to provide information and guidance on good practice on strategic, organizational, managerial, technological and safety aspects of decommissioning, through its reports, training activities, workshops and collaborative projects.

References

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