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# Nuclear Fuel Cycle and Waste Management

## Objective

*To support Member States in raising awareness and promoting sustainable (safe, secure, effective, innovative) fuel cycle and life cycle management for nuclear energy programmes and nuclear applications users, and contingency planning for a post-incident situation. To support Member States in strengthening their capabilities and human resources, or having access to the best available knowledge, technologies and services.*

## Uranium Resources and Processing

The new publication *Geochemical and Mineralogical Characterization of Uranium and Thorium Deposits* (IAEA-TECDOC-1929) provides a summary of the research and selected papers from a completed coordinated research project (CRP) on this topic. The project led to a better understanding of the genesis of uranium and thorium mineralization and improved evaluation of uranium and thorium resources.

The Agency published *World Uranium Geology, Exploration, Resources and Production*, a comprehensive 'one stop' summary and reference volume for world uranium geology and resources, allowing insight into potential future uranium discoveries and supply. Another new publication, *Descriptive Uranium Deposit and Mineral System Models*, provides a set of systematic descriptive models for each uranium deposit type, subtype and class, enabling Member States to assess the potential of remaining or speculative uranium resources for long term supply in a consistent and reproducible manner.

The Agency published the proceedings of the International Symposium on Uranium Raw Material for the Nuclear Fuel Cycle: Exploration, Mining, Production, Supply and Demand, Economics and Environmental Issues (URAM-2018), held in 2018.

## Nuclear Power Reactor Fuel

The new publication *Analysis of Options and Experimental Examination of Fuels for Water Cooled Reactors with Increased Accident Tolerance (ACTOF)* (IAEA-TECDOC-1921) captures the results of a CRP of the same title, which developed and improved modelling of advanced fuel concepts and supported the collection of the experimental data needed for the introduction of such fuels into commercial reactors.

The publication *Modelling of Fuel Behaviour in Design Basis Accidents and Design Extension Conditions* (IAEA-TECDOC-1913) reports on Member States' capabilities in modelling, predicting and improving their understanding of the behaviour of nuclear fuel under accident conditions and presents the main results and outcomes of a CRP on this topic.

The Agency also published *Light Water Reactor Fuel Enrichment beyond the Five Per Cent Limit: Perspectives and Challenges* (IAEA-TECDOC-1918), which captures the conclusions of two technical meetings on the benefits of using high assay low enriched uranium fuel, with due consideration of safety issues that arise from its use.

The Agency designated the National Nuclear Laboratory of the United Kingdom as a Collaborating Centre to support Member States in implementing programmatic activities in the field of advanced fuel and advanced fuel cycles.

## Management of Spent Fuel from Nuclear Power Reactors

The Agency published the proceedings of the 2019 International Conference on the Management of Spent Fuel from Nuclear Power Reactors: Learning from the Past, Enabling the Future. A new CRP entitled 'Spent Fuel Characterization' is aimed at sharing information among Member States on issues related to the characterization of spent nuclear fuel in the various steps of its management.

## Radioactive Waste Management

The Agency issued three new publications on radioactive waste management in 2020. *Costing Methods and Funding Schemes for Radioactive Waste Disposal Programmes* (IAEA Nuclear Energy Series No. NW-T-1.25) provides guidance on developing cost estimates for a disposal programme and establishing funding mechanisms. It is applicable to all waste categories and both near surface and geological disposal, and contains relevant examples and case studies from national programmes (Fig. 1). *Design Principles and Approaches for Radioactive Waste Repositories* (IAEA Nuclear Energy Series No. NW-T-1.27) describes the



FIG. 1. Director General Grossi visits the ONKALO deep disposal site in Olkiluoto, Finland, in November.

approaches and principles to be considered by responsible organizations involved in the planning and design of radioactive waste disposal facilities. *Underground Disposal Concepts for Small Inventories of Intermediate and High Level Radioactive Waste* (IAEA-TECDOC-1934) presents underground disposal concepts other than a mined deep geological repository that may provide a safe and economical solution for the relatively small inventories of radioactive waste arising in Member States without a major nuclear power programme.

### *Management of disused sealed radioactive sources*

The Agency's International Catalogue of Sealed Radioactive Sources and Devices (ICSRS) was updated with a modernized user interface and search functionality. The ICSRS contains information on more than 5000 different types of radioactive sources, 4000 radioactive devices and over 1000 manufacturers or suppliers worldwide.

A new CRP entitled 'Developing a Framework for the Effective Implementation of a Borehole Disposal System' was launched to provide Member States with a package of essential materials for the development of borehole disposal and to make this disposal solution more readily implementable.

## **Decommissioning and Environmental Remediation**

### *Decommissioning*

At the Technical Meeting on Advancing Collaboration on Competence Building and Knowledge Management for Decommissioning, participants discussed good practices and lessons learned in capturing and sharing knowledge and experience relevant to the decommissioning of nuclear facilities, including relevant activities being undertaken at the national and international levels (Fig. 2).

The Agency issued the *IAEA Follow-up Review of Progress Made on Management of ALPS Treated Water and the Report of the Subcommittee on Handling of ALPS treated water at TEPCO's Fukushima Daiichi Nuclear Power Station*. The review concluded that the two options for controlled disposal outlined by a Japanese advisory subcommittee in February – vapour release and discharges to the sea – were both technically feasible.

The new publication *Decommissioning of Particle Accelerators* (IAEA Nuclear Energy Series No. NW-T-2.9) presents relevant experience and lessons learned. It is intended to contribute to decommissioning planning during the design stage of new facilities, minimizing the generation of radioactive waste without compromising structural characteristics and the effectiveness of the construction.

The Agency launched a new collaborative project on the decommissioning of sodium cooled fast reactors to collect information on recent status, good practices, issues and challenges associated with decommissioning such reactors.

### *Environmental remediation*

More than 680 participants from 105 Member States gathered at the International Conference on the Management of Naturally Occurring Radioactive Material (NORM) in Industry, held as a virtual event. The conference endorsed the need for clear policies at the national level, based on well defined inventories and sound cost estimation methodologies, to enable the establishment of NORM waste management strategies.

Participants in the Technical Meeting on the Use of Controls for Radioactively Contaminated Land exchanged good practices and experiences in approaches to and performance of controls for radioactively contaminated land.



FIG. 2. Workers dismantling the turbine hall at Ignalina nuclear power plant measure scrap metal for traces of radiation (file photograph).