Joint IAEA-NEA-EC/JRC Workshop on the Taxonomy and Related Terminology of Fuel Cycles for Molten Salt Reactors, Vienna, 3 – 7 November 2025

IAEA Nuclear Fuel Cycle and Materials Section Activities' on Nuclear Fuel Cycles for MSRs

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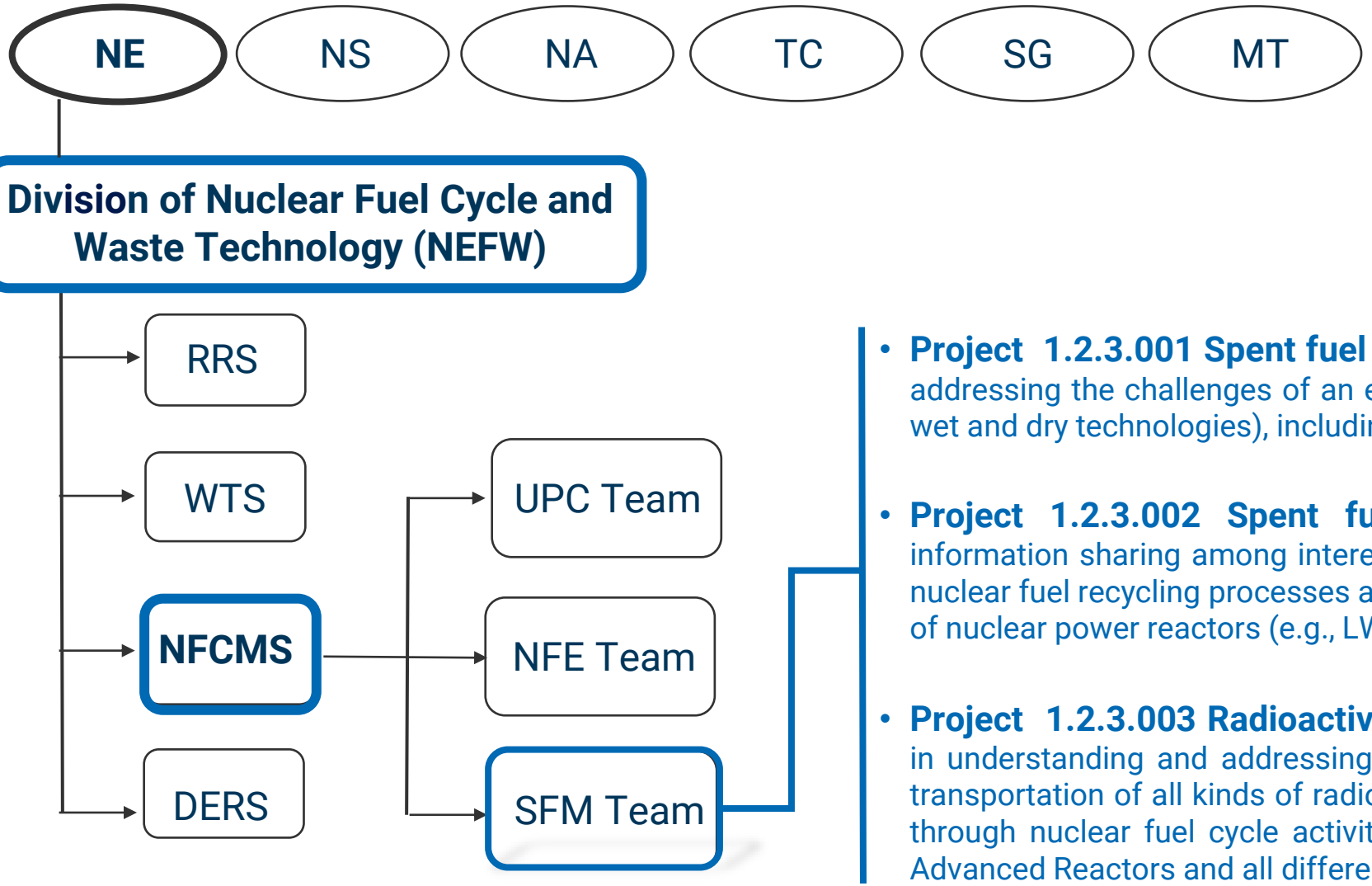
IAEA's Organization

Department of Nuclear Energy



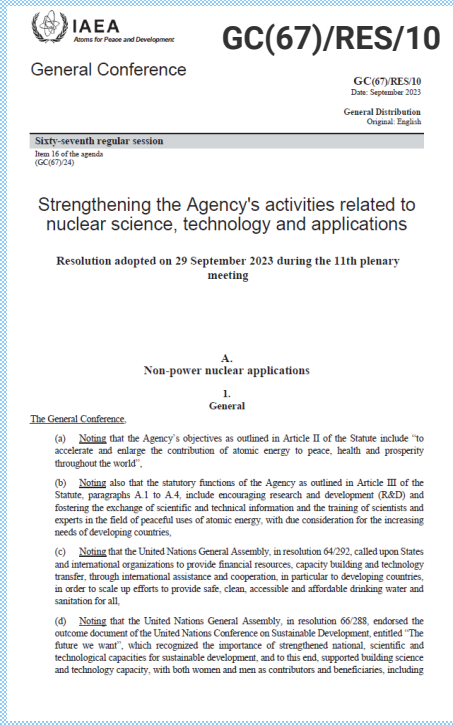
- **Project 1.2.3.001 Spent fuel storage:** To support MSs in understanding and addressing the challenges of an effective and safe storage of their SNF (through wet and dry technologies), including anticipating those generated by SMRs
- **Project 1.2.3.002 Spent fuel recycling:** To facilitate discussion and information sharing among interested MSs on recent and future developments in nuclear fuel recycling processes and technologies for current and next generations of nuclear power reactors (e.g., LWRs, FRs, SMRs)
- **Project 1.2.3.003 Radioactive materials transportation:** To support MSs in understanding and addressing the challenges and issues related to the safe transportation of all kinds of radioactive and nuclear materials used or generated through nuclear fuel cycle activities, including SNF from current fleet of LWRs, Advanced Reactors and all different SMRs technologies

IAEA's Role and Activities

General Conference

- Established in 1957, as an autonomous organization within the UN system, the IAEA actively supports its 180 Member States to improve their capabilities **to develop and deploy Advanced Reactors and related innovative Fuel Cycle technologies** with the aim to reduce the waste burden and to enhance the sustainability of nuclear power

- **Biennial programmes** (e.g., 2024 - 2025) considering Member States' recommendations & requests expressed through the yearly adopted resolutions, during the General Conferences
- **Standing Advisory Groups (SAGs)**
  Standing Advisory Group on Nuclear Energy (**SAGNE**): a group of international experts advising (yearly) the Director General on nuclear power, fuel cycle and nuclear science issues
- **Technical Working Groups (TWGs)**
  Groups of international experts advising (yearly) the DDG-NE on the orientation and implementation of NE programmatic activities (ex: **TWG on Nuclear Fuel Cycle Options and Spent Fuel Management (TWG-NFCO)**)


IAEA Atoms for Peace and Development

GC(67)/RES/10

General Conference

GC(67)/RES/10
Date: September 2023

General Distribution
Original: English

Sixty-seventh regular session

Item 16 of the agenda
(GC(67)/24)

Strengthening the Agency's activities related to nuclear science, technology and applications

Resolution adopted on 29 September 2023 during the 11th plenary meeting

A.
Non-power nuclear applications

1.
General

The General Conference,

(a) Noting that the Agency's objectives as outlined in Article II of the Statute include "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world",

(b) Noting also that the statutory functions of the Agency as outlined in Article III of the Statute, paragraphs A.1 to A.4, include encouraging research and development (R&D) and fostering the exchange of scientific and technical information and the training of scientists and experts in the field of peaceful uses of atomic energy, with due consideration for the increasing needs of developing countries,

(c) Noting that the United Nations General Assembly, in resolution 64/292, called upon States and international organizations to provide financial resources, capacity building and technology transfer, through international assistance and cooperation, in particular to developing countries, in order to scale up efforts to provide safe, clean, accessible and affordable drinking water and sanitation for all,

(d) Noting that the United Nations General Assembly, in resolution 66/288, endorsed the outcome document of the United Nations Conference on Sustainable Development, entitled "The future we want", which recognized the importance of strengthened national, scientific and technological capacities for sustainable development, and to this end, supported building science and technology capacity, with both women and men as contributors and beneficiaries, including


TWG-NFCO, April 2025

Technical Working Group on Nuclear Fuel Cycle Options and Spent Fuel Management (TWG-NFCO)

20 Member States (Belgium, Canada, China, Finland, France, Hungary, India, Japan, RoK, Mexico, Netherlands, Romania, Russia, Spain, Sweden, Slovakia, UK, UAE, Ukraine, USA). **Four International Organizations** (EC, OECD/NEA, WNA and WNTI)

TWG-NFCO focuses on nuclear fuel cycle options with an emphasis on:

- **Spent fuel management** (storage, recycling and transportation)
- **Innovative fuel cycles** (multirecycling, minor actinides management and P&T of long-lived fission products)
- **Nuclear materials management**

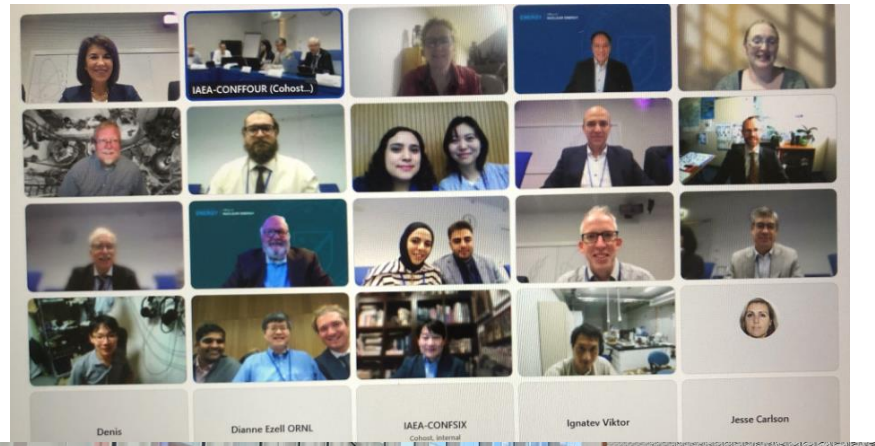
In its Annual Meeting in April 2019, TWG-NFCO recommended the IAEA that:

- *"… the IAEA has several Sections looking into several different aspects of SMR deployment…, however, fuel cycle and in particular spent fuel management from SMRs does not appear to be a topic of investigation.*
- *The next update of the Advances in Small Modular Reactor Technology Developments Report should consider technologies for managing SNF from SMRs including the back-end infrastructure that would be needed to support SMRs (e.g. transportation, storage, recycling, and disposal).*
- *Nuclear fuel cycle aspects, in particular the backend, should be integrated into all IAEA working groups that are looking at SMRs…"*

TWG-NFCO Meeting, 1-3 April 2025

International Workshop on the Chemistry of Fuel Cycles for Molten Salt Reactor Technologies, 2-6 Oct. 2023, in cooperation with the OECD/NEA

- **Held in Vienna on 2-6 October 2023, co-organised by the NEA and the IAEA**
- **44 participants** (28 onsite + 16 online) including **MSR developers, R&D organisations, regulators and industry experts** from 13 countries and the EU
- Several **technical sessions** including technical presentations, “thoughts from the floor” sessions and panel discussions with all the presenters
- **Breakout sessions** for the participants to engage in further discussion and work together to identify gaps and needs: experimental underpinning; irradiations; monitoring and operation; irradiated fuel treatment (material and waste streams)



Workshop chaired by Dr. M. Edmondson (NNL, UK)

Technical Sessions

International Workshop on the Chemistry of Fuel Cycles for Molten Salt Reactor Technologies, 2-6 Oct. 2023, in cooperation with the OECD/NEA

Technical Session	Chairs
MSR concepts and nuclear fuel cycle. Listening to developers	J. Serp (CEA)
Salt preparation (impact of salt impurities)	P. Souček (JRC) E. Capelli (Orano)
Cross-cutting issues: Modelling for molten salt chemistry, Thermophysical data; Standardization; Material compatibility; Safeguards (accountancy)	V. Ignatiev (Kurchatov) C. H. Lee (KAERI
Online and/or at-line processing (clean-up), including off-gas treatment	J. Uhlíř (ÚJV Řež) J. Willit (DOE)
Offline processing of irradiated fuel salts (at reactor site or centralized)	T. Koyama (CRIEPI) S. Kung (DOE)

Overview of Session's Discussions (1/2)

Session on Molten Salt Reactor concepts and nuclear fuel cycle

- MSR developers have different viewpoints on management of irradiated fuel salt with once through-fuel and closed fuel cycles being developed
- A large part of the discussion was dedicated to establishing a common terminology for the MSR fuel cycles

Session on Cross-cutting issues

- Discussions during this session covered cross-cutting issues for both fluoride and chloride based MSRs with thermal and fast neutron spectrum including modelling and measurements for molten salt chemistry, thermophysical data, standardization, and material compatibility

Session on Operational treatment including off-gas treatment

- Both fast and thermal spectrum MSRs will require off-gas treatment to remove the volatile and aerosolized fission products
- The need for online removal of soluble fission products in a molten chloride fast spectrum MSR will be much less compared to the thermal spectrum MSR system

Overview of Session's Discussions (2/2)

Session on Reprocessing of irradiated fuel salts (at reactor site or centralized)

- The session recognized the need to establish recommendations and guidelines for some aspects as:
  - Requirements for reprocessing and once through treatments
  - Determination of optimum processes to recover actinides from molten salts
  - Establish storage and disposal options for irradiated molten salts
  - Evaluate fission product accumulation effects on reactor operation for removal prioritization
  - …

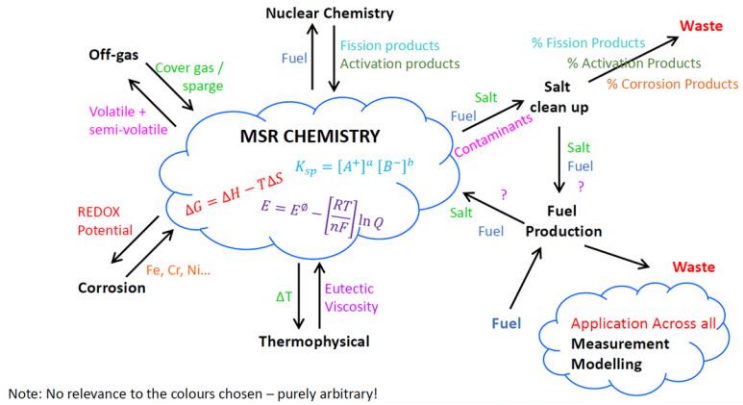
Break Out Sessions

1. Experimental Underpinning
2. Irradiations
3. Monitoring and Operation
4. Irradiated fuel: Operational treatment and reprocessing

Main Findings and Conclusions from the Joint IAEA/NEA Workshop

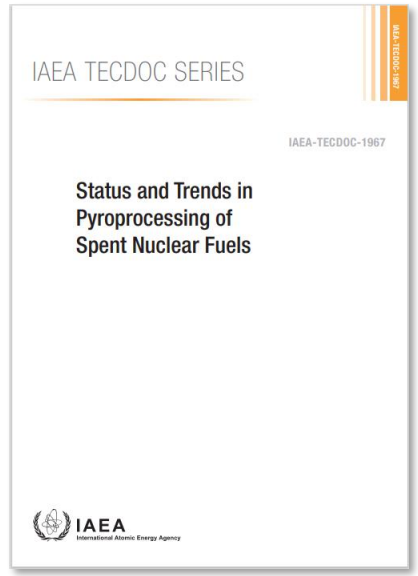
- Needs for a **common terminology for the MSR fuel cycles** to clarify the difference between reactors using solid fuels and molten salt reactors.
- Needs for **definitions of the variety of salt treatment and conditioning** presented by developers, e.g. in-line, on-line, at-line, off-line treatment options.
- Needs for **development of a taxonomy of MSRs' fuel cycle options.**
- **Early engagement by reactor developers with national regulators** is highly recommended to define the necessary set of requirements for irradiation testing.

A harmonized set of related **terminology** and **taxonomy** of MSR fuel cycles is needed to enhance and facilitate effective communication and collaboration **across the different stakeholders** (e.g., developers, researchers, implementors, regulators and decision makers) on this complex topic.



Note: No relevance to the colours chosen – purely arbitrary!

Courtesy Dr. Mike Edmondson, NNL (UK)



Joint IAEA-NEA-EC/JRC Workshop on the Taxonomy and Related Terminology of Fuel Cycles for Molten Salt Reactors

3 - 7 November 2025

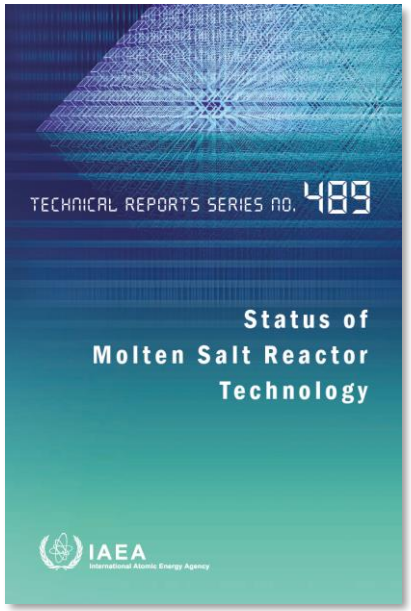
IAEA International Atomic Energy Agency

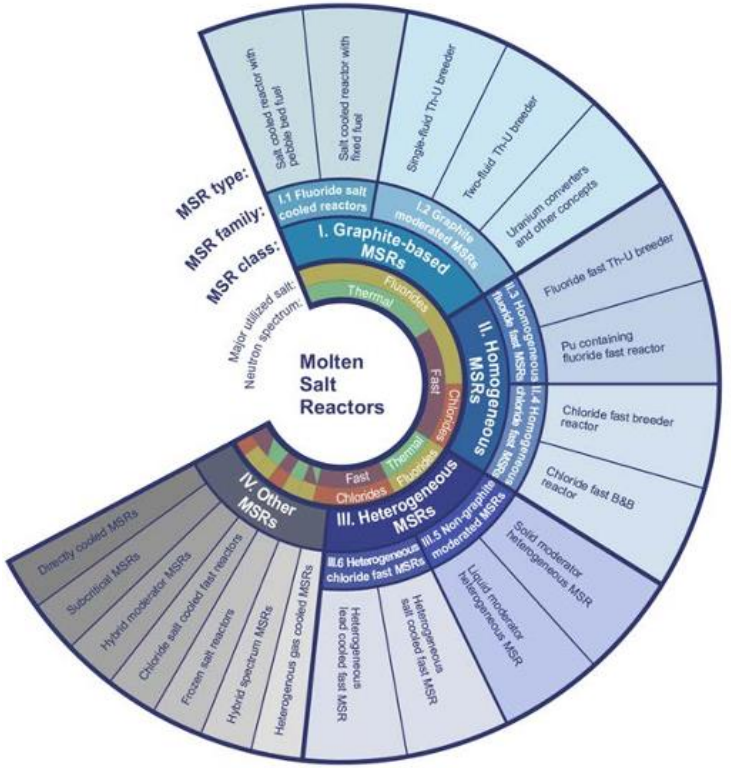
NEA NUCLEAR ENERGY AGENCY

European Commission

Main Objectives

- To identify and establish a **taxonomy** for the fuel cycle options associated to molten salt reactor technologies.
- This effort will build on the **MSR taxonomy** described in the IAEA Technical Reports Series No. 489 on the Status of Molten Salt Reactor Technology, published in 2023.
- To draft a **consistent and robust terminology for MSR fuel cycles** to facilitate effective communication and collaboration across the different stakeholders (e.g., developers, researchers, implementors, regulators and decision makers) on this complex topic.



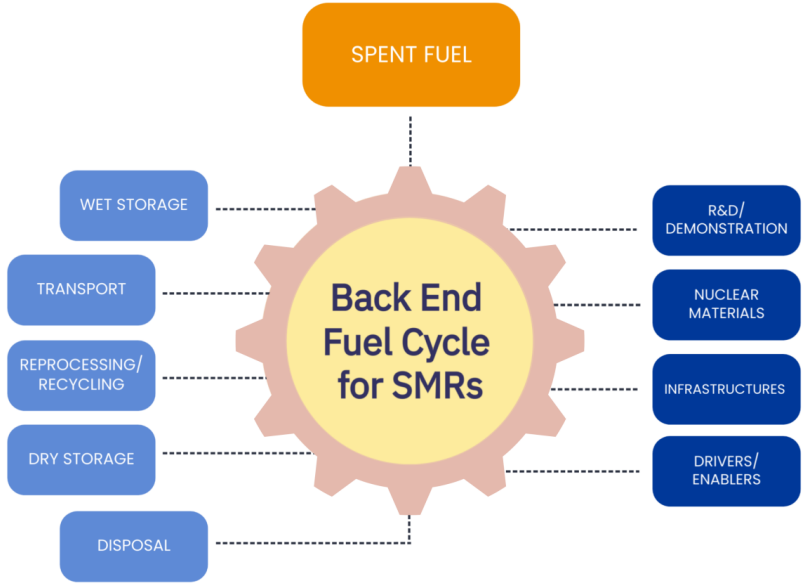


Source: "Status of Molten Salt Reactor Technology" IAEA, Technical Reports Series no. 489

Coordinated Research Project on *Challenges, Gaps and Opportunities for Managing Spent Fuel from SMRs*

Understanding the implications of the management of new spent fuels is paramount to make informed decisions

SMR-COGS, CRP T13021



MAIN OBJECTIVES and OUTPUTS

Development of **specific roadmaps** for managing spent fuel from the different SMR technologies, identifying **what can be derived, optimized or adapted from existing practices, or what needs to be fully developed**

- **All SMR technologies included**: LWRs (LEU, LEU+, HALEU), HTGR (TRISO (compact, pebbles)), FRs (Metallic, Oxide, Nitrides, …), MSRs
- **To compare various SMR systems**, in terms of efforts required to develop and implement an SFM strategy

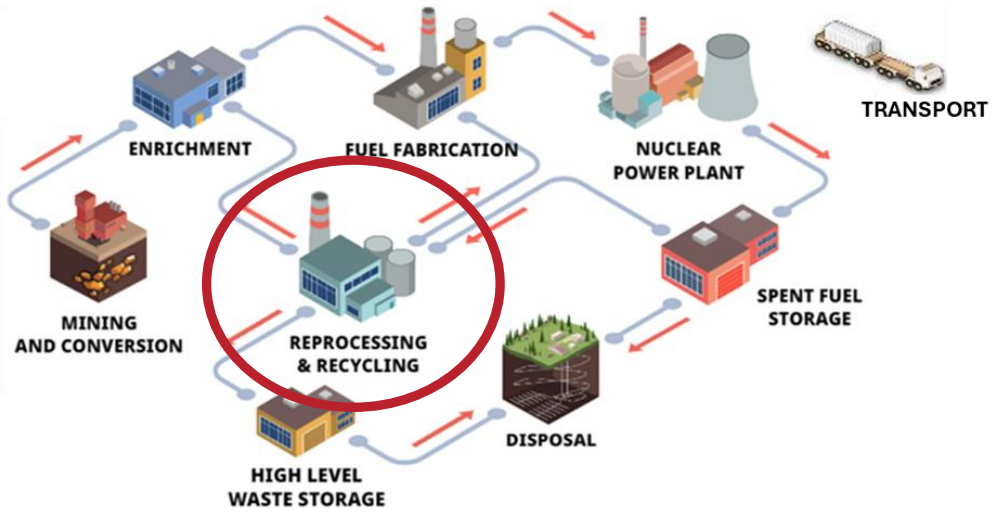
First Research Coordination Meeting of SMR-COGS CRP held on 11 to 15 November 2024

STATUS of the Coordinated Research Project SMR-COGS

- ***14 Research Contracts*** from ARG, ARM, CPR, CZR, EGY, INS, LIT, MEX, POL, ROM(2), UKR(3)
- ***18 Research Agreements*** from CAN(2), CPR, DEN, EGY, JOR, NOR, SIN, SPA, SWE, TUR, UK(2), USA(5)

45+ participants from 25 countries

- Industry, Operators, Researchers, Regulators, …
- Embarking (Phase 1, 2 and 3), Expanding, Mature
- Observers: OECD/NEA, FIN, FRA, NET, RUS



NFCMS International Conferences in 2026

- International Conference on Fast Reactors and Related Fuel Cycles (FR26) in Beijing (China) from **18 to 21 May 2026** (In collaboration with IAEA/NPTDS)

- International Conference on Fuel Supply Chain for Sustainable Nuclear Power Development in Vienna from **13 to 15 October 2026** (NFCMS)
  - Topic 1. Industry Prospects and Challenges Facing Raising Fuel Supply Demand
  - Topic 2. Supply and demand of raw materials for nuclear fuel supply
  - Topic 3. Advanced nuclear fuels for innovative reactor technologies
  - Topic 4. Industrial and Innovative technologies for recycling nuclear materials

Spent Fuel Management Network

SFM.Contact-Point@iaea.org

Welcome to the IAEA International Network on Spent Fuel Management - SFM Net

The spent fuel management (SFM) network is a forum for the sharing of practical experience and international developments on spent fuel management.

Its main objectives are to facilitate the efficient exchange of information, communication and cooperation amongst professionals working in the back end of the fuel cycle – from its removal from a reactor core to its final disposition (i.e. SNF wet and dry storage, transportation, handling and retrieval, reprocessing and recycling, economics of the back-end of nuclear fuel cycle, damaged SNF management, stakeholder involvement, communication issues, etc.)

The establishment of the SFM Net is aimed at fostering safe, sustainable and efficient spent nuclear fuel management practices across all IAEA Member States.

For further information or questions please contact SFM.Contact-Point@iaea.org.

Featured Publications

SEE ALL

Spent Fuel Performance Assessment & Research (SPAR-IV) | Status and Trends in Pyroprocessing of Spent Nuclear Fuels | Phenomenology, Simulation & Modelling of Accidents in Spent Fuel Pools | Management of Spent Fuel from Nuclear Power Reactors Learning from th... | Demonstrating Performance of Spent Fuel & Related Storage System... | Management of Spent Fuel from Nuclear Power Reactors

Events 2025

- Technical Meeting on Operating Experience and Lessons Learned on Managing Non-Standard Legacy Spent Fuels from Power and Research Reactor (18 – 21 February 2025) *EVT2304628*
- Third Coordination Research Meeting on Spent Fuel Research and Assessment (24 – 28 March 2025) *EVT2404557*
- 23rd Meeting of the Technical Working Group on Nuclear Fuel Cycle Options and Spent Fuel Management (01 – 04 April 2025) *EVT2403024*
- Technical Meeting on the Behaviour of Spent Fuel and Cladding During Storage and the Performance of Spent Fuel Storage Systems (23 – 27 June 2025) *EVT2406873*
- Technical Meeting on the Management of Spent Fuel (Pebble Beds and Prismatic) from High Temperature Gas Cooled Reactors (7 – 11 July 2025) *EVT2404558*
- Joint IAEA-NEA Workshop on the Taxonomy and Related Terminology of Fuel Cycles for Molten Salt Reactors (29 September – 03 October 2025) *EVT2404560*
- Workshop on the Challenges in Managing Spent Evolutionary Advanced Technology Fuels (10 – 14 November 2025) *EVT2205116*
- Technical Meeting on the Operation and Maintenance of Storage and Transportation Casks (09 – 12 December 2025) *EVT2404726*

Latest News

NEW CRP: Challenges, Gaps and Opportunities for Managing Spent Fuel from Small Modular Reactors (T13021)

IAEA's Learning Management System!

With the addition of 3 new modules, the course on Spent Fuel Storage is available on IAEA's Learning

Already a member? Members Area →

Not a member yet? Join Here →

New infographics now available!

Thank You