Joint IAEA-ICTP
Workshop on Reactor Physics, Thermal Hydraulics and Plant Design Engineering of Small Modular Reactors (SMR4212)
13 -16 April 2026

MSR Fuel: Development status. IAEA activity on MSR Fuel

Anzhelika Khaperskaia,
Technical Lead (Fuel Engineering and Fuel Cycle Facilities)

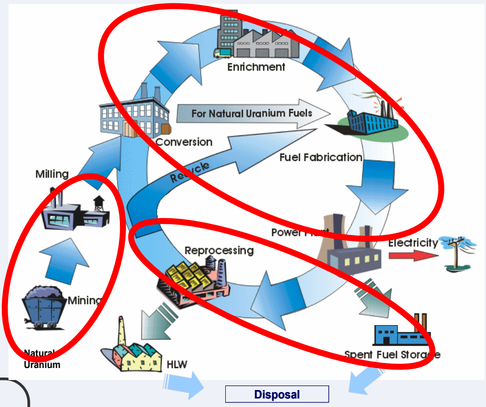
NFCMS /NEFW, IAEA

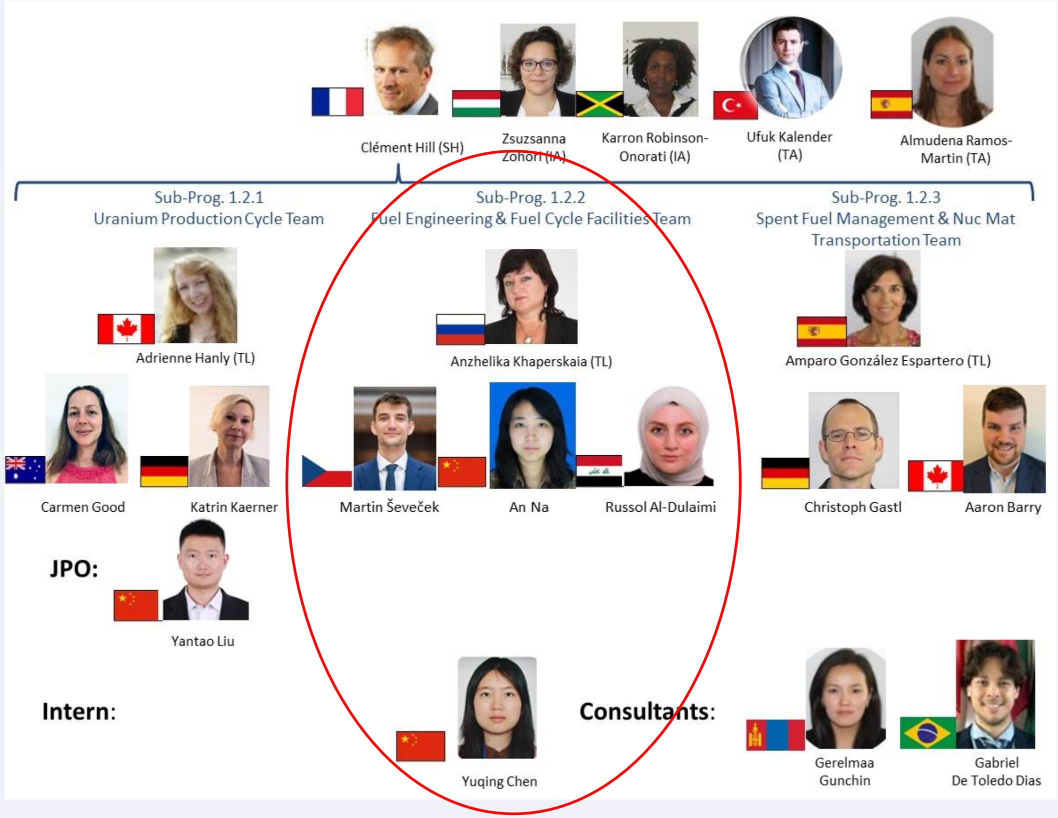
Nuclear Fuel Cycle and Materials Section (NFCMS)

NE | NS | NA | TC | SG | MT

Division of Nuclear Fuel Cycle and Waste Technology (NEFW)

- RRS
- WTS
- NFCMS
  - UPC Team
  - NFE Team
  - SFM Team
- DERS





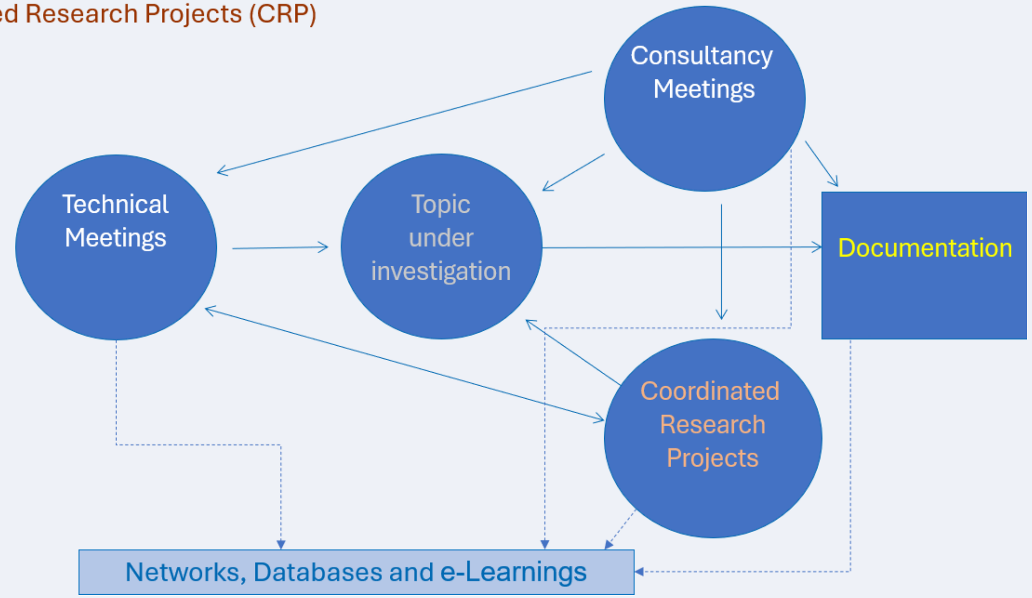
- **Project 1.2.2.001**: **Fuel engineering and operation for current generations of nuclear power reactors**
- **Project 1.2.2.003** : **Fuel engineering and operation for SMRs and next generations of nuclear power reactors**
- **Project 1.2.2.002**: **Fuel cycle facilities operation and life management**

IAEA Sub-Programme 1.2.2:
Nuclear Power Reactor Fuel and Fuel Cycle Facilities

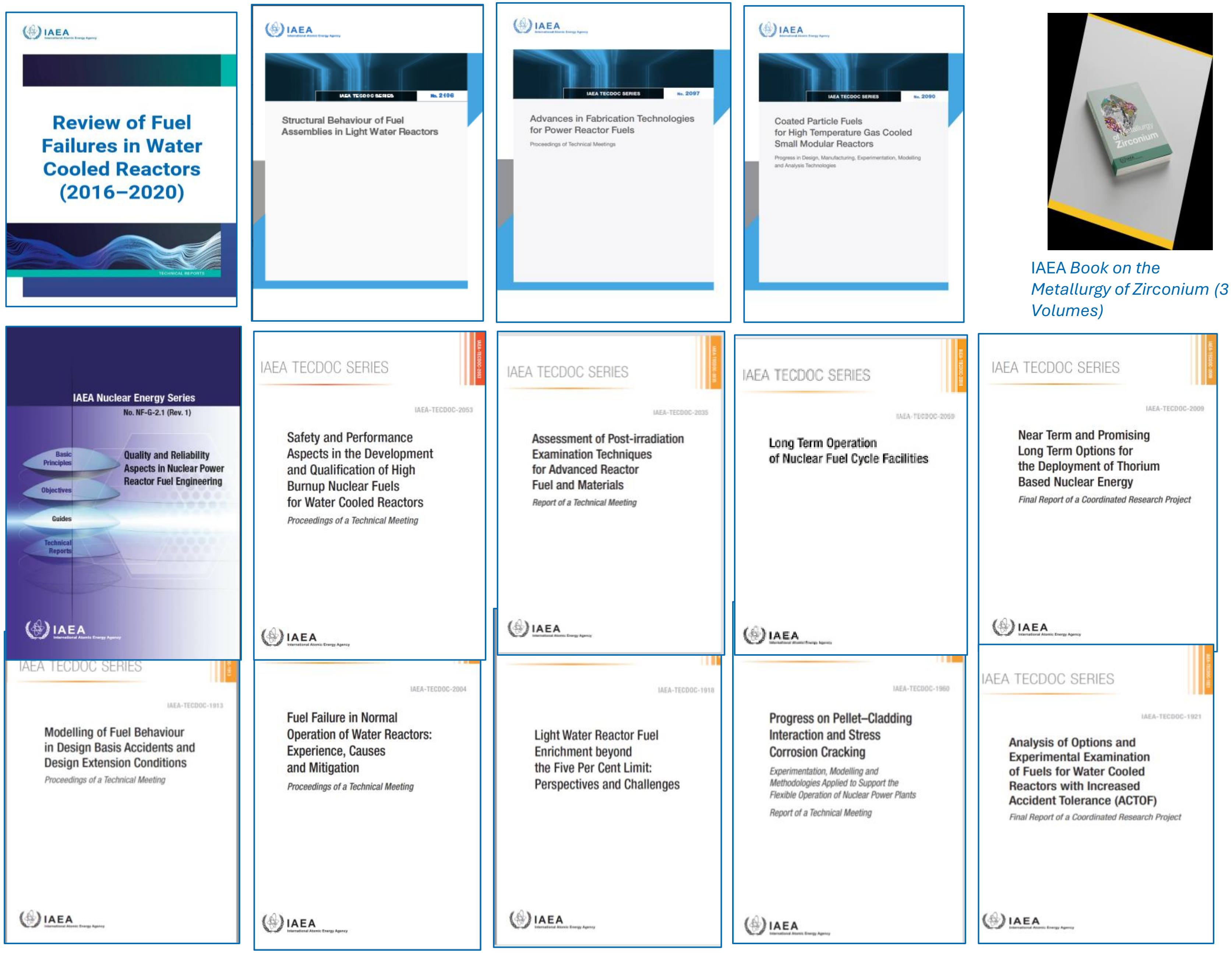
- Organizing IAEA meetings and developing IAEA publications
- Coordinating research activities (CRPs)
- Maintaining databases (NFCFs, PIE: Integrated Nuclear Fuel Cycle Information System - IAEA INFCIS), IAEA Fuel and material database (The IAEA Fuel and Material Database - IAEA Data Platform) and NFC simulation tools (NFCSS: Nuclear Fuel Cycle Simulation System (NFCSS))
- Developing e-Learning Materials on nuclear fuel and PIE: OPEN-LMS: All courses
- Building up Networks among experts (NFE-Net): Pages - NFE Net
- Supporting the IAEA Technical Cooperation Programme

To foster collaboration and information exchange, provide reference data, preserve knowledge, and capacity building

- Consultancy Meetings (Expert Reviews)
- Technical Meetings
- Coordinated Research Projects (CRP)



Publications on Fuel Engineering & FCF (2021-2026)



IAEA Book on the Metallurgy of Zirconium (3 Volumes)

- **IAEA Book on the Metallurgy of Zirconium**
- **NES NF-T-2.5 (Rev.1) :** Review of Fuel Failures in Water Cooled Reactors in 2016-2020 ([Review of Fuel Failures in Water Cooled Reactors (2016–2020) [IAEA Preprint]])
- **IAEA-TECDOC-2106** Structural Behaviour of Fuel Assemblies in Light Water Reactors **(2025)**
- **IAEA-TECDOC-2097** Advances in Fabrication Technologies for Power Reactor Fuels: Proceedings of Technical Meetings held in 2021 and 2023 (2025)
- **IAEA-TECDOC-2090** Coated Particle Fuels for High Temperature Gas Cooled Small Modular Reactors **(2025)**
- **IAEA-TECDOC-2059** Long Term Operation of nuclear fuel cycle facilities **(2024)**
- **IAEA-TECDOC-2053 :** Safety and Performance Aspects in the Development and Qualification of High Burnup Nuclear Fuels for Water Cooled Reactors **(2024)**
- **IAEA NES No NF-G-2.1:** Quality and Reliability Aspects in Nuclear Power Reactor Fuel Engineering **(2024)**
- **IAEA-TECDOC-2035:** Assessment of Post-irradiation Examination Techniques for Advanced Reactor Fuel and Materials
- **IAEA-TECDOC-2009**: Near Term and Promising Long-Term Options for the Deployment of Thorium Based Nuclear Energy - Final Report of a Coordinated Research Project
- **IAEA-TECDOC-1889**: Fuel Modelling in Accident Conditions - Final Report of a Coordinated Research Project on Fuel Modelling in Accident Conditions – FUMAC, 2014–2018
- **IAEA-TECDOC-1918**: Light Water Reactor Fuel Enrichment beyond the 5% Limit: Perspectives and Challenges
- **IAEA-TECDOC-1960**: Progress on Pellet–Cladding Interaction and Stress Corrosion Cracking: Experimentation, Modelling and Methodologies Applied to Support the Flexible Operation of Nuclear Power Plants

4

IAEA ongoing activity to support current generation of nuclear power reactors fuels

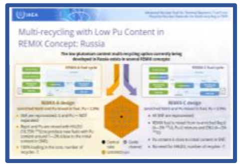
Fuel engineering and operation for current generation of nuclear power reactors

- **Accident Tolerant Fuels**
- 1. ***CRP T12032*** on "*Testing and Simulation of Advanced Technology and Accident Tolerant Fuels* (ATF-TS)" (2020-2024)

2. TM on "Advanced Technology Fuels: Progress on their Design, Manufacturing, Experimentation, Irradiation, and Case Studies for their Industrialization, Safety Evaluation, and Future Prospects" (28-31 October 2025)

3. ***New CRP*** on "Testing and Performance Simulations of Advanced Technology Fuels (ATF-TS II)(2026 -?)

Fuels for recycling/multi-recycling



1. TECDOC on "*Mixed Oxide Fuels Design, Operation and Management*" (in preparation to publishing)

2. IAEA publications on "*Challenges and Opportunities in Reprocessed Uranium Fuels*" (TECDOC in progress)

Conventional Water-Cooled Reactor fuels

- 1. NES on "*Review of Fuel Failures in Water Cooled Reactors (2016–2020) Rev.1*" (in pre-print)

2.TM on "*Advances in Fuel Design, Manufacturing and Examinations for Pressurized Heavy Water Reactors*" (November 2024, Argentina)

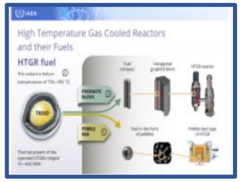
3.TM on "*Digitalization and the Use of Artificial Intelligence in Advanced Nuclear Fuel Manufacturing and Quality Control", 27-31 July* 2026

IAEA ongoing activities to support advanced reactors fuels development

Fuel engineering and operation for SMRs and future generations of nuclear power reactors

- **Water-cooled SMR fuels**
  1. TECDOC on *"Core and Plant Simulation with an Emphasis on Fuel Behaviour in Light Water Reactor Based Small Modular Reactors"* (based on Workshop 27-29 February 2024, TECDOC in progress)

- **Fast reactor fuels**
  1. ***CRP T12031*** *on "Fuel Materials for Fast Reactors (FMFR)"* (2019-2023: Final Report in preparation to publishing)
  2. *NES Technical Report on "Nuclear Fuel Technologies for Liquid Metal Cooled Fast Reactors (LMFRs)"* (in preparation to publishing)
  3. *Workshop on the "Behaviour of Liquid Metal Cooled Fast Reactors Fuels"* (30 June – 04 July 2025)
  4. ***New CRP*** on *""Fuel Materials for Fast Reactors II (FMFR-2)"* (2026…)
- **HTRs SMR fuels**
  1. ***CRP T12034*** *on "Fuel Modelling Exercises for Coated Particle Fuel for advanced reactors including SMR"(2024-2029)*

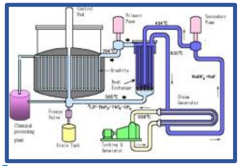


Molten salt SMR fuels

1. *New Simulation tool module development for MSR with relevant fuel cycle*
2. *Workshop on "Molten Salt Reactor Fuel: Recent Development and Future Challenges"* (21-25 July 2025)
3. *Workshop on "Current Status of Structural Material Development for Molten Salt Reactors and Related Challenges"* (20-24 July 2026)

HALEU fuel

1. *Workshop on "Operational Aspects of Manufacturing High Assay Low Enriched Uranium Advanced Fuels"* (17-21 August 2026)



PIE for SMR fuels

1. ***CRP T12033*** *on "Standardization of Subsized Specimens for Post-Irradiation Examination and Advanced Characterization of Fuel and Structural Materials for Small Modular Reactor and Advanced Reactor Applications (PIE for SMR)"(2024-2028)*

Molten Salt Reactors under development

The only operational liquid-fuel MSR program globally

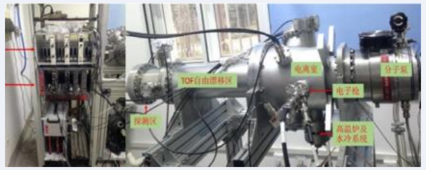
The experimental TMSR-LF1 thorium-powered molten salt reactor in Wuwei, Gansu Province, has achieved the first successful conversion of thorium-uranium nuclear fuel (Nov. 2025)

HALEU fuel, Th inventory of about 50 kg , conversion ratio of about 0.1.

A fertile blanket of FLiBe (with 99.95% Li-7), fuelled with uranium tetrafluoride (UF4).

MSR Fuel Ecosystem: Developers, R&D, and Emerging Supply Chain (No Commercial Fuel Producers Yet)

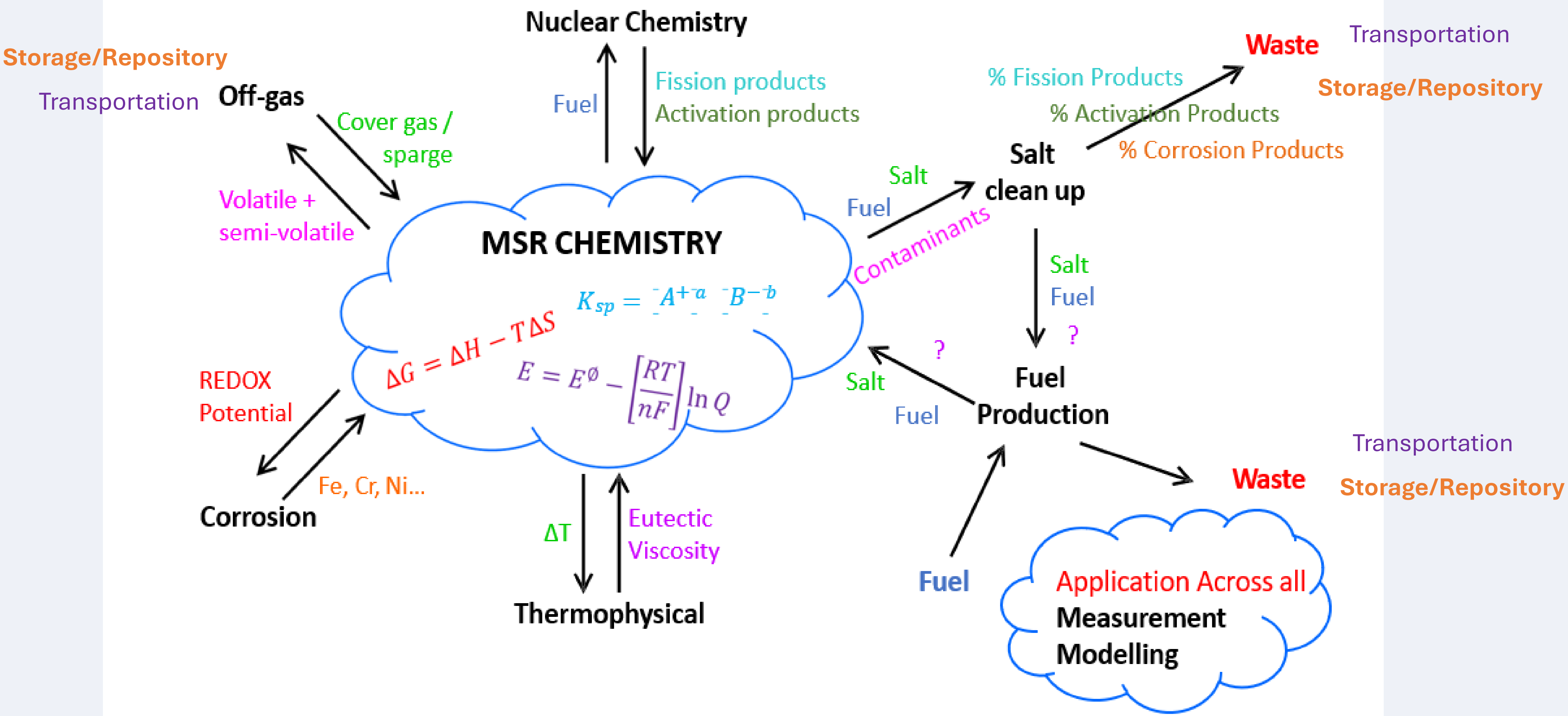
🧪 **SINAP (China)**	World's leading operational MSR program (TMSR-LF1), thorium cycle R&D, salt processing (fluorination/distillation)
🧪 **US R&D ecosystem: ORNL, INL , ANL, PNNL, Universities (USA)**	Legacy MSR expertise, Thermophysical data , Corrosion / redox chemistry, Salt qualification, Providing R&D support to multiple MSR developers (e.g., Terrestrial Energy, TerraPower)
🧪 **EC R&D ecosystem : JRC (Petten, Karlsruhe, Ispra)**	Researching on thermodynamic databases , irradiation studies, fuel salt synthesis, electrochemistry, thermo- physical properties, materials testing,
🏭 **TerraPower (USA)**	MCFR developer; molten chloride fuel R&D and component testing (pumps, heaters, and freeze valves in a molten salt loop for 1,000 hours). Partnership with Southern Company, ORNL, EPRI, and Vanderbilt University,
🏭 **Seaborg Technologies (Saltfoss Energy) (Denmark)**	CMSR developer, with the uranium-based fluoride salt fuel . Collaboration with KEPCO and Samsung to develop the fuel production capabilities
🏭 **Terrestrial Energy (Canada/UK)**	IMSR® developer, sealed core with fluoride HALEU fuel salt, fuel is integrated into reactor supply model, pilot facility with Springfields Ltd,
🏭 **Copenhagen Atomics (Denmark)**	Thorium+LEU MSR, fuel producers (scaling up), critical experiment in Switzerland (2026/27). One of the closest entities to true MSR fuel industrialization
🏭 **Moltex Energy (Canada/UK)**	SSR, liquid salt inside conventional-style fuel pins, WATSS pyroprocessing for chloride fuels
🏭 **ThorCon (USA/Indonesia)**	Liquid fluoride fuel; industrial-scale salt purification and batch fuel production strategy (shipyard manufacturing model), partnering with BRIN on engineering and fuel salt technology
🏭 **Flibe Energy (USA)**	LFTR, demonstrated lab-scale U/Th $LiF\text{-}BeF_2$ fuel production
🏭 **Natura Resources (USA)**	MSR-1 (at Abilene Christian University), HALEU-based fuel, partnering with the Utah San Rafael Energy Lab (USREL) for fuel synthesis and to qualify fuel salt
🏭 **Rosatom (Russia)**	10MWt Li,Be,An/F test MSR , Molten Salt Actinide Recycler and Transmuter
🌐 **European MSR ecosystem Orano + Stellaria / Thorizon / Naarea**	Researching fuel salt chemistry, safety demonstration, integration with La Hague reprocessing infrastructure.



Curtesy: Copenhagen Atomics

HALEU supply chain is bottleneck
Possible producers:
Rosatom
Centrus Energy
Urenco
Orano

CHEMISTRY IN MSR



Adapted from Mike Edmondson, NNL, UK

MSR Fuel: Top 5 Technical Bottlenecks

Fuel Salt Chemistry Control (Core Challenge)

- Maintaining **redox stability** under irradiation
  - Redox potential shifts during burnup; UF_4 tends to oxidize, UCl_3 tends to reduce. Temperature and redox windows are critical for stable salt operation.
- Managing **fission product solubility**
- Preventing corrosion via chemistry control
  - Tellurium relevance: Its behaviour and interaction with redox control in the salt is important, especially when UF_3/UF_4 couples are absent.

👉 *Continuous chemistry control is required — unlike solid fuel systems*

Materials Corrosion & Compatibility

- Structural materials exposed to:
  - High t (~600–800°C)
  - Chemically aggressive salts
- Long-term degradation of Alloys (Ni-based, steels), Graphite (if moderated)

👉 *Materials lifetime is a primary licensing risk*

Fuel Salt Production & Purification (Scale Gap)

- High-purity salt synthesis (LiF-BeF_2, chlorides)
- Removal of: Moisture, oxygen, metallic impurities
- Isotopic enrichment: **Li-7**, **Cl-37** (^{7}Li enrichment critical to neutron economy and T management. ^{37}Cl enrichment crucial for molten chloride fast reactors; lab-scale methods under development)

👉 *No industrial-scale MSR fuel salt production exists today*

Online Fuel Processing & Off-Gas Handling

- Continuous removal of:
  - Xe/Kr (neutron poisons)
  - Tritium
- Salt cleanup:
  - Fission products
  - Noble metals

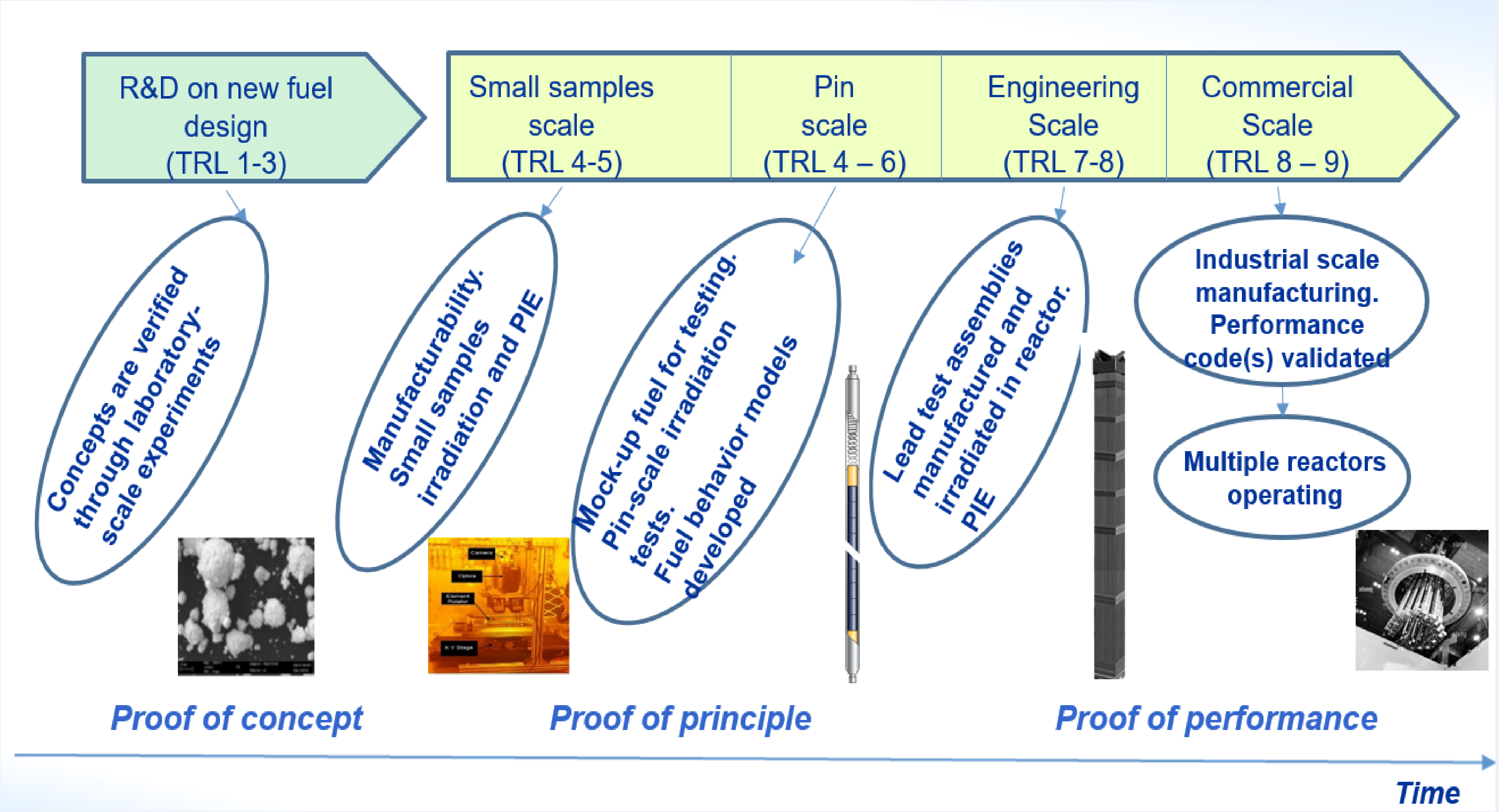
👉 *MSRs require **chemical plant + reactor integration***

Qualification, Testing & Regulatory Framework

- Limited: Irradiation data ; Fuel performance database
- Complex safeguards for **circulating fuel**

👉 *Regulatory pathway remains undefined*

TRL for Advanced Nuclear Fuels Development

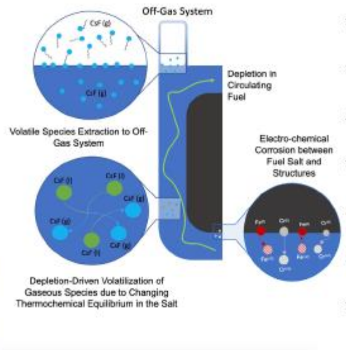


Current efforts on MSR fuel qualification (examples from USA and Copenhagen Atomics)

Salt and Materials Interaction

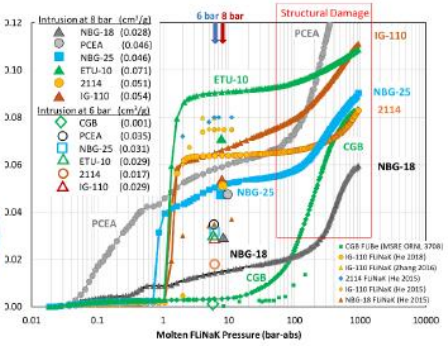
Supporting MSR development by studying corrosion (SS 316H, Alloy 709, Alloy 625, Haynes 244 of various alloys in presence of F and Cl salts)

2021 ORNL FLiBe TCL

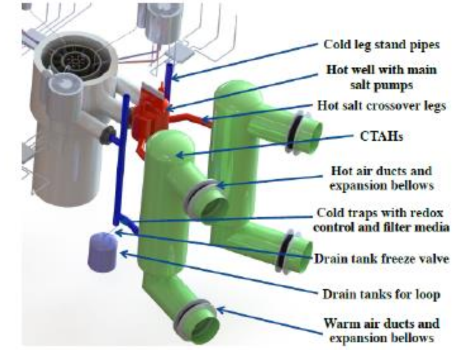


Graphite-Salt Study

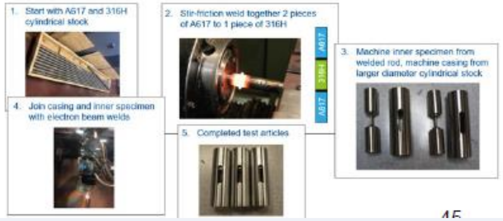
Study of salt intrusion in graphite and chemical interactions that may affect graphite's structural or physical properties



Development of Test Articles for Surrogate Materials Surveillance



Test Articles Fabrication Completed – Both Types Follow the Same Basic Process



IRRADIATION NACL/UCL$_3$

- Chloride salt selected as limited irradiation data
- Synthesized world's first sample of HEU (93 wt.% ^{235}U) bearing UCl_3-NaCl eutectic
- Salt-facing wall material: IN-625
- Other structural material: SS-316
- He/Ar mixture for experiment: 15/85
- First irradiation – 8/21/2023
- Final irradiation – 6/3/2024
- Number of reactor runs – 54
- Total run time – 390 hours
- Burnup – 92 MWh

POST-IRRADIATION EXAMINATION (PIE) BEGINS ON FIRST-OF-A-KIND ENRICHED URANIUM FUEL SALT (INL)

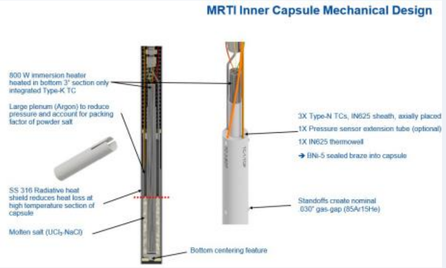
The irradiated salt capsule was removed from NRAD on June 4th, 2024, after nearly 400 hours of irradiation.

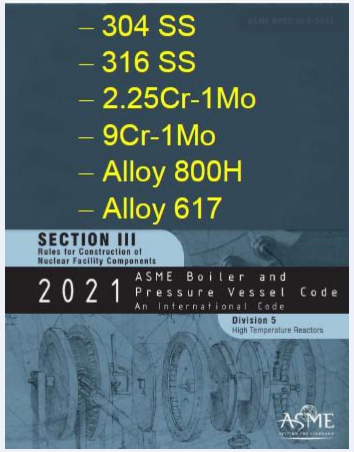
On July 11th, 2024, the experiment was successfully transferred to the HFEF hot cell to begin PIE activities.

Early results indicate that (1) the salt did not freeze uniformly in salt capsule, and (2) fission products were able to be detected in the irradiated salt sample.

Next steps:

- Leverage temperature reading data to benchmark novel INL tools
- Leverage freezing data from radiography scan to model salt freezing behavior
- Leverage PGS data to evaluate thermochemistry and retention rates of radionuclides in salt



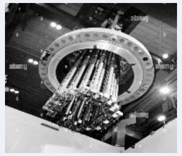


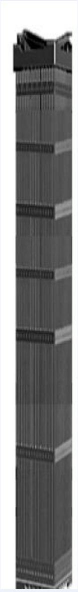
Courtesy of Dr. Patricia Paviet, PNNL

Inside Enclosure Furnace | Prototypic test section | Delivered March 5, 2024 | Unpackaged and Positioned

Courtesy of Aslak Stubsgaard, Copenhagen Atomics

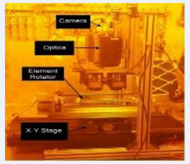
New Nuclear Fuels' Deployment (TRLs max internationally)





WCR: UO_2 (conventional)
HTR: TRISO (UO_2)
FR: UO_2, $(U\text{-}Pu)O_2$, (U-Pu) N, U-Zr, U-Pu-Zr

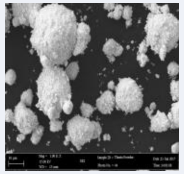
Proof of performance
(TRL 7-9)
Near term

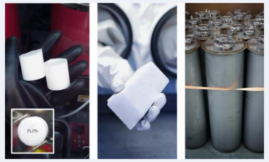


HTR:
TRISO (UCO, UN, UC and other types)

Molten salt fuels

Proof of principle
(TRL 4 - 6)
Intermediate term





Proof of concept
(TRL 1-3)
Long term

For MSR fuel: TRL 3–6 depending on fuel salt chemistry (fluoride vs chloride) and reactor configuration
Key focus: Scaling salt production + integrated processing systems

Workshop on Molten Salt Reactors Fuels: Recent Development and Future Challenges , 21 July – 25 July 2025

45 experts	12 IAEA Staff	13 MSs	IO (OECD Nuclear Energy Agency NEA)	Canada
Czech Republic	Denmark	France	India	Indonesia
Italy	Korea	Netherlands	Russian Federation	Switzerland
	United Kingdom	United States of America		

Workshop on Fuel Performance Assessment and Behaviour for Liquid Metal Cooled Fast Reactors. Programme

Chair of the Workshop: Ms Patricia Paviet (PNNL for DOE-NE Advanced Reactor Technologies)

Technical Session I. MSR fuels salt synthesis processes, Scaling Up Fuel Synthesis and Packaging.

- Chairs: Ms Mouna SAOUDI (CNL, Canada) and Kim PAMPLIN (ACU, USA)

- **Technical Session 2 - Characterization and Qualification of MSR Fuel Salt.**
  - Chairs: Mr Tony BIRRI, (ORNL) and Mr Thomas DUMAIRE (Stellaria)
- **Technical Session 3. Purification Technologies for MSR Fresh Fuel Salt –**
  - Chairs: Mr Theodore BESMANN (USA) and Mr David LAMBERTIN (NAAREA, France)

Technical Session 4. Modelling and Simulation tools for fuel salt mixtures in-reactor behaviour.

- Chairs: Mr Jiri KREPEL (PSI, Switzerland) and Mr Matt CHRISTIAN (SNL USA)

42 presentation in total

MSR Fuel Salt Synthesis & Qualification : Summary of discussion

Molten Salt Reactor fuel salt synthesis is progressing at the lab scale but scaling up to industrial production faces technical and infrastructure challenges.

Key Challenges:

•**Gaps in data** on thermophysical properties, corrosion, and radiolysis (Prioritization needed for missing thermophysical and chemical property data. Impurities significantly influence properties. Irradiation data from MSRE and new experiments (UCl_3/NaCl) are underway)

•**No agreed-upon purity/qualification standards** (MSR developers set their own specifications. Labs have different recipes, sharing is limited. Consensus on purity standards, standardized synthesis methods are lacking but needed for confidence in property data)

•**Limited industrial-scale MSR fuel salt production and enrichment** (^{7}Li, ^{37}Cl) capacity

•Complex regulations for MSR , fuel salt transport (Fresh and irradiated salts require careful handling)

MSR Fuel Salt Modeling and Simulation: Summary of discussion

Expert knowledge on chemistry is fundamental for M&S (data reliability, phenomena identification and ranking)

Catalog / overview of the major salts and their binary and ternary diagrams with comments about chemistry / neutronics?

Research can be guided by phenomena identification ranking tables of safety claims

- **Engineering codes like MELCOR** for supporting safety assessment to include the MSR chemistry.
- **Chemistry models** are needed as input for the development of mechanistic source term calculation tools.
- **Molecular dynamics (MD)** can support the extension of thermophysical properties DB but needs validation for trustability
- **Fuel cycle consideration** with neutronics, TH and chemistry consideration can guide the choice of salt in the MSR design
- **Coupling** between different simulation codes (e.g., neutronics, thermal-hydraulics, chemistry) remains a challenge, test different approaches
- **Open-source (OS) codes** can promote the development of new features (for fuel cycle but not only)

IAEA ongoing activities to support the development of MSR fuel. Workshop on the Current Status of Structural Material Development for Molten Salt Reactors and Related Challenges: 20 – 24 July 2026

Status of MSR technology development, with a focus on structural material requirements:

Recent research and development results on candidate structural materials suitable for MSR environments.

Material selection and qualification, and the current status of qualification of structural materials for MSR

Corrosion mechanisms in molten fluoride and chloride salts for MSRs and related fuel cycle applications, including the effects of radiolysis and impurities :

Embrittlement from helium produced by transmutation of nickel;

Corrosion and grain boundary embrittlement caused by fission products, particularly tellurium.

Compatibility of molten salts and structural materials under operational conditions.

- Experimental ***methods and loop testing for structural materials in contact with molten salts*** to simulate realistic operational conditions.
- ***Multi-physics modelling*** to capture the complex interactions among neutronics, thermal-hydraulics, fuel salt chemistry and materials corrosion phenomena.
- ***Advanced manufacturing techniques*** and robotics for MSRs and related fuel cycle applications.
- Methods and plans ***to monitor the integrity of structural materials*** chosen for MSRs.
- Licensing, regulatory, and safety considerations related to structural materials in MSRs,
  Lessons learned from pilot-scale MSR projects and industry experience.
- Collaborative approaches to data sharing, and future research priorities, fostering international cooperation and harmonization of testing and qualification protocols.

Simulation tool (NFCSS)

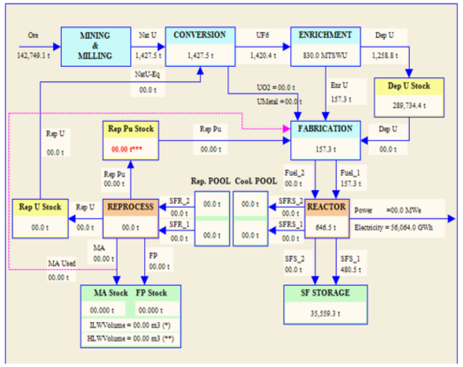
IAEA | INFCIS

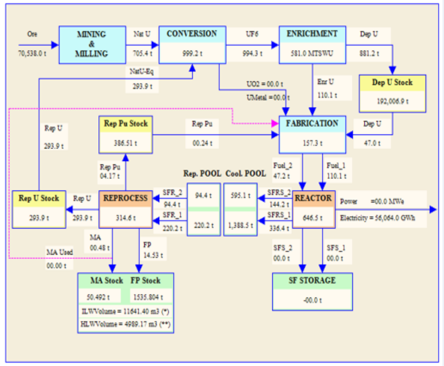
NFCFDB UDEPO PIEDB **NFCSS** KHAPERSKAIA, Anzhelika

NUCLEAR FUEL CYCLE SIMULATION SYSTEM

About Modeling Example Calculation Scenarios Help References

- NFCSS is a scenario-based publicly available computer model (web-based tool) for the estimation of nuclear fuel cycle material and service requirements
- Reactors types: PWRS, BWRs, PHWRs, RMBKs, AGRs, GCRs, WWERs , FRs
- UOX, MOX and ThOX fuel cycles
- Calculates the requirements for Nat U resources, enrichment and fuel fabrication services, etc. SF inventory, Minor Actinide Inventory, FP inventory, Decay Heat and Radio-toxicity with material Flow Diagrams up to 200 years





Technical Features

- ORIGEN II (PWR-UO2-33G, PWR-MOX and BWR-UO2-27.5G, BWR-Pu) fuel libraries

  PWR (Pu-Th MOX) : ORIGEN II library (211) Pu-Th fuel (with modifications)

  BWR (Th fuel cycles) : ORIGEN II PWR Th- library (214)

  Other reactors : Libraries provided by Consultant experts

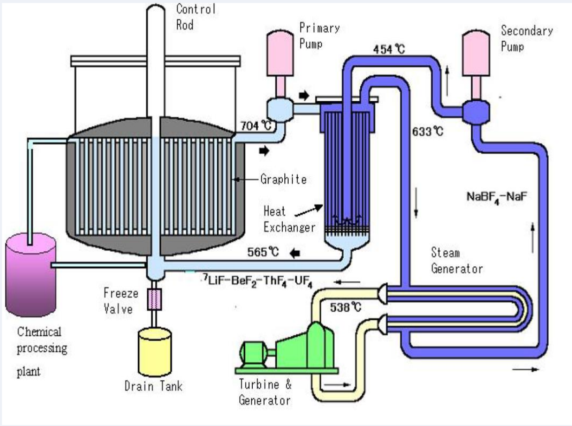
Nuclear Fuel Cycle Simulation System (NFCSS)

	Open cycle	Closed Cycle	
The total natural uranium (2025 to 2110)*	337831 tones	202973 tones	
The total spent fuel (or HLW) accumulated in the end of life cycle	37228 tones of SNF	High-level waste	5405 tones
		Plutonium	478 tones
		Minor actinides	54.7 tones

* Example for calculation for NES with 10 PWRs (45GWd/t burn up) having a 60-years lifespan

NFCSS: on going activity

- Development of a module for Molten Salt Reactor fuel cycle scenario analysis
- Development of a calculation module for Deep Geological Repository sizing
- Development of a fuel cycle cost calculation module
- Extending the NFCSS capabilities for HALEU fuel for different reactor types.
- Development of a module for HTR fuel cycle requirements simulation



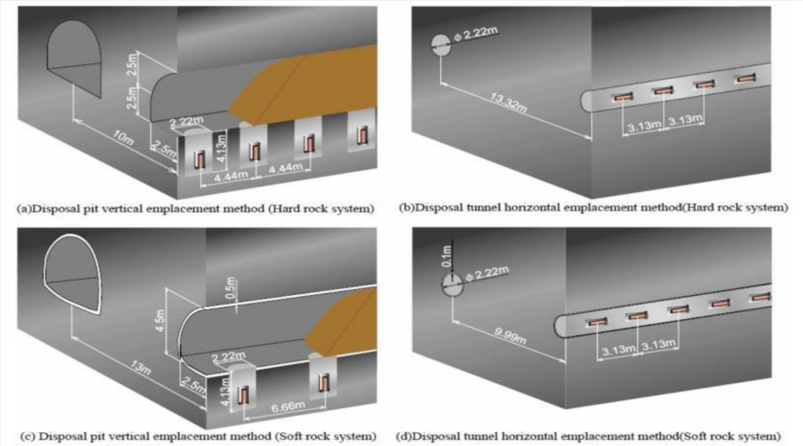
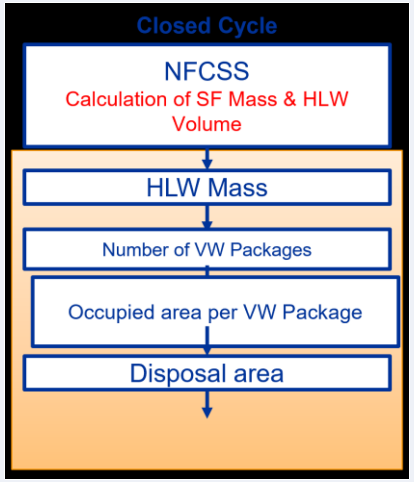
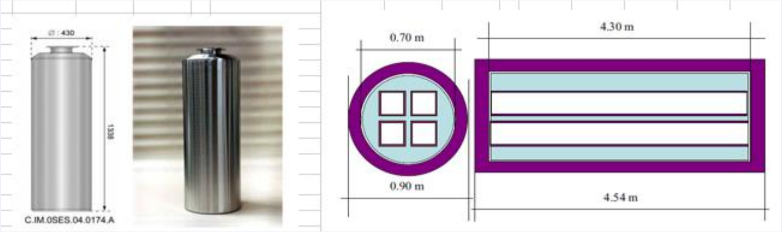
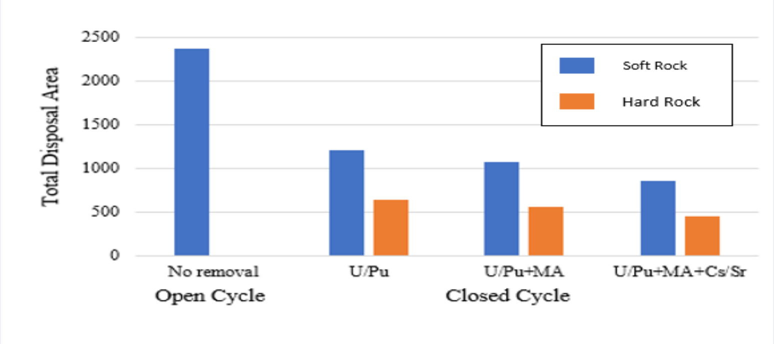


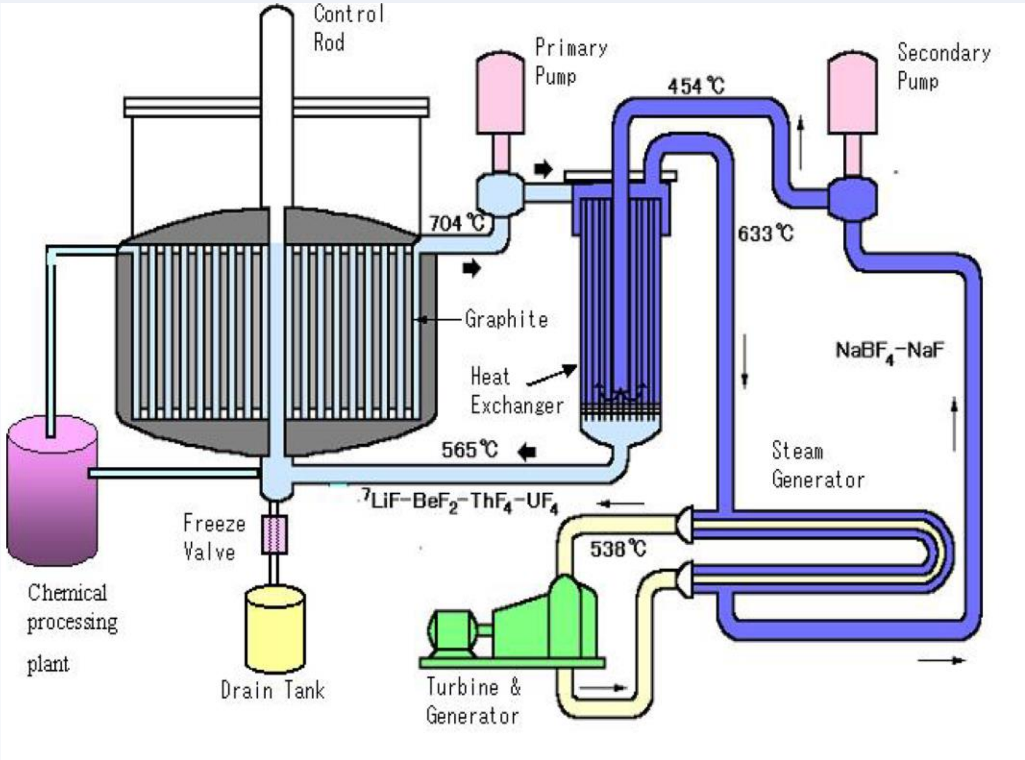
Figure 4.2.2-6 Specifications of the disposal tunnel and the waste package pitch







NFCSS applicability to Advanced Reactors: MSR model (Th base Fuel cycle)



Case Studies for Simulation of MSRs

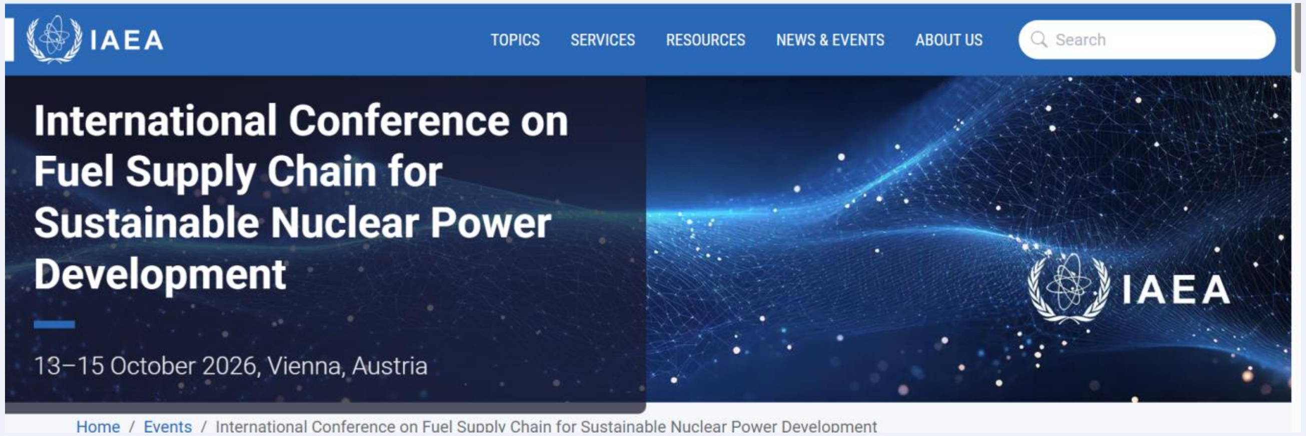
1. Case-1 Th/^{233}U fuel
2. Case-2 Th/Pu fuel
3. Case-3 Th/LEU fuel
4. Case-4: Fast spectrum MSR (Th/^{233}U fuel)

- *Batch reprocessing after 1 year*
- *Comparison with ORIGEN and SRAC codes*

Results

1. Case -1 Very close with ORIGEN (+/- 5%)
2. Case-2 Within 11.4%
3. Case-3 Within 12.9%
4. Case-4 Within 10%

International Conference on Fuel Supply Chain for Sustainable Nuclear Power Development, Vienna, from 13 to 15 October 2026



Key Deadlines and Dates

1 February 2026

- Submission of abstracts through IAEA-INDICO
- Submission of Form B (together with Form A) through the InTouch+ platform

31 March 2026

- Notification of acceptance of abstracts for oral or poster presentation

10 April 2026

- Submission of Form C (together with Form A) through the InTouch+ platform

[International Conference on Fuel Supply Chain for Sustainable Nuclear Power Development | IAEA]

Topic 1. Industry Prospects and Challenges Facing Raising Fuel Supply Demand:

Challenges in supply chain and front-end services to meet the increasing infrastructure requirements for conversion, enrichment and fuel fabrication

Topic 2. Supply and demand for raw materials for nuclear fuel supply:

Innovations in the front end of the nuclear fuel cycle, from exploration to mining: (new uranium exploration and mining projects, Innovative advancements in uranium exploration and mining, Uranium and thorium resources, processing and mining and the circular economy

Topic 3. Advanced nuclear fuels for innovative reactor technologies:

Advanced technology fuels and fuels for advanced reactors: design, qualification and operation of ATFs, LEU+ and HALEU fuels, TRISO fuels, fuels for Fast Reactors, MSRs and multiple recycling in all types of reactors, advances in nuclear fuel fabrication processes and quality control (automation, additive manufacturing and use of artificial intelligence)

Topic 4. Industrial and Innovative technologies for recycling nuclear materials

Industrial operating experience and lessons learned in reprocessing for recycling to increase recourse base of NE

SUMMARY

- MSR fuel development is progressing worldwide, with active programmes across North America, Asia, and Europe.

- Key challenges include ensuring high fuel salt purity, establishing international standards, and addressing gaps in thermophysical and thermochemical data.

- Priorities focus on scaling up salt production, enabling continuous purification and monitoring, integrated processing systems, overcoming constraints in isotopic supply (^{7}Li, ^{37}Cl), developing consistent modelling frameworks, shared databases, and integrated multi-physics tools.

- The International Atomic Energy Agency (IAEA) supports these efforts by fostering collaboration, providing reference data, and encouraging Member State participation in coordinated activities to accelerate MSR technology development.

Thank you

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