NEXSHARE:

IAEA Network for Experiments and Code validation Sharing for SMRs and Advanced Reactors

Technical Meeting on Advances and Innovations in Fast Reactor Design and Technology

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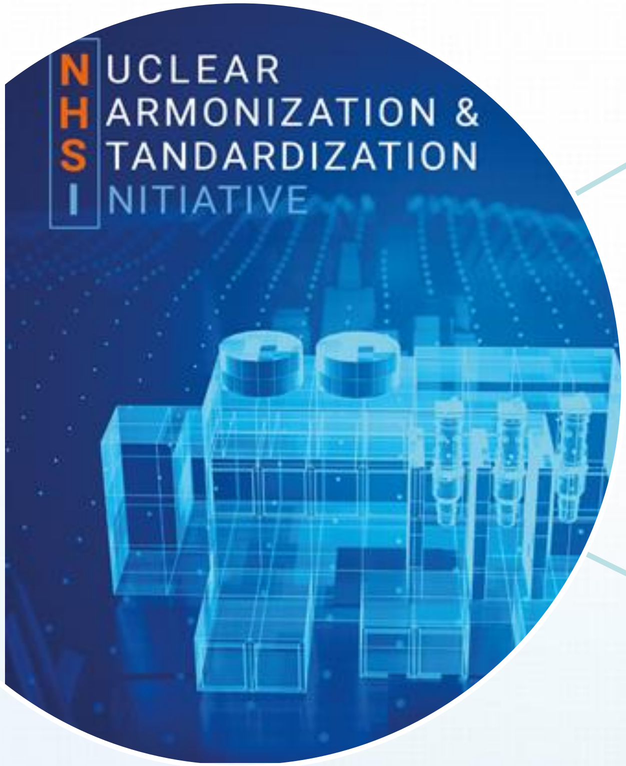
Background: NHSI Industry Track

Effective Global Deployment of Safe and Secure Advanced Nuclear Reactors



Harmonization of Regulatory Approaches Track

- **WG1:** Framework for information exchange
- **WG2**: International pre-licensing regulatory reviews
- **WG3:** Leveraging other regulatory reviews

IAEA as facilitator

within and between the tracks

Harmonization and Standardization of Industrial Approaches Track

- **Topic 1:** Harmonization of high-level user requirements
- **Topic 2**: Information sharing on Codes and Standards
- **Topic 3:** Experimental Testing and Validation for Design and Safety Analysis Computer Codes
- **Topic 4:** Acceleration of nuclear infrastructure implementation for SMR

Regulators

Governments

Technology Holders

Operators and other end-users

International Organisations and Associations

Topic 3: Experimental Testing and Validation for Design and Safety Analysis Computer Codes

The focus of this Topic was to establish a global cooperation mechanism for experiments and code validation for SMRs, between entities operating experimental facilities, technology holders and potentially TSOs.

The **general objectives** of Topic are to:

1. **Share information on existing experimental programs. Identify potentials for resource sharing and synergies.**
2. **Provide greater reach and enhanced utilization of existing experimental facilities.**
3. Provide greater confidence on data and codes used in safety cases.
4. Reduce costs and increase schedule certainty of experiments and code validation needed for SMRs.

Phase I (2023-2024)

Phase II (2025-2026)

During the **first phase**, we have established a network to serve as a global cooperation mechanism for sharing of experiments and code validation for design and safety analysis computer codes (**NEXSHARE**).

Note: sharing information on experiment and code validation does not necessarily mean sharing data, but identifying what is available, what work is being conducted, what are the gaps and what facilities are currently available. Agreeable conditions for sharing (data or resource) are to be established between interested parties.

NEXSHARE – Members

The **NEXSHARE** network is an international community of professionals promoting information sharing and collaborations on experimental programmes, code validation, and available experimental facilities for SMRs.

Members:

- SMR Design Organizations: 23 participating organization from 13 MS, and more to come!
  CNEA, Terrestrial Energy, CNNP, SPIC, CGN, Copenhagen Atomics, Seaborg, Jimmy, Nuward, Mitsubishi, International Thorium Molten-Salt Forum, Toshiba, Thorizon, KAERI, Raten ICN, Rosatom, STL Nuclear, Rolls-Royce SMR, General Atomics, GE-Hitachi, Last Energy, Kairos Power
- Experimental Facilities & Codes Developers
- TSO
- In collaboration with the OECD/NEA, the GEN-IV Forum and the European Commission for further synergies.

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Technologies included:

- Water Cooled SMRs
- High Temperature Gas Cooled Reactors
- Liquid Metal Fast Reactors
- Molten Salt Reactors

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NEXSHARE – Governance and Web Interface

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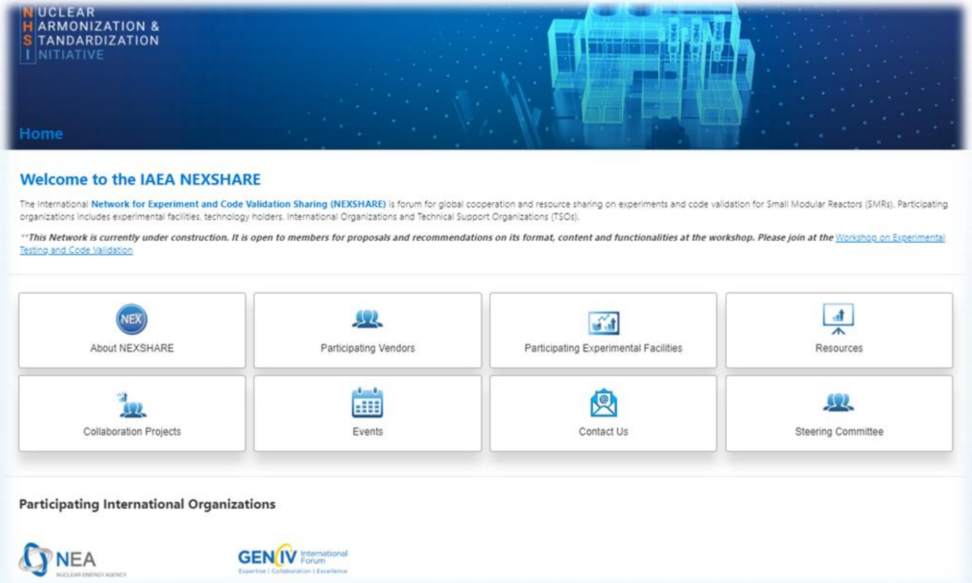
A **Steering Committee (SC)** has been appointed to provide strategic guidance and oversight to the Network.

The SC members are experts in experimental facilities and code validation for SMRs.

Their responsibilities include:

- Setting the overall direction and goals of the Network,
- Providing guidance on network activities and initiatives, and
- Ensuring alignment with the network's objectives and mission.

Representatives of collaborating International Organizations are sitting at the SC.



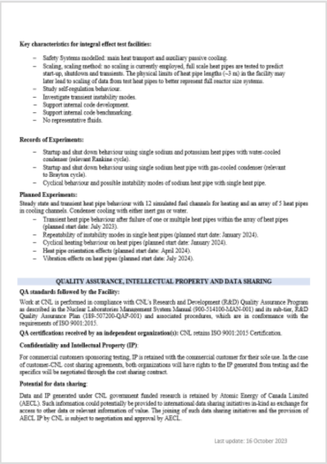
Web Interface / Portal:

- Centralizes/links to the information, events, publications and projects relevant to the topic, from different organizations.
- Means to contact the members and create opportunities for sharing and initiating bilateral collaborations.

NEXSHARE – Database of Experimental Facilities

Database of Experimental Facilities Applicable to SMRs

- Available from the NEXSHARE web interface, continuously expanded and updated.
- Through filtering and search, members can find facilities that can be contact for access existing data or generate new data needed for code validation.
- Built on projects from / with the collaboration of the OECD/NEA and Gen-IV Forum
- Focus:
  - Support code validation for design and safety analysis of SMRs
  - Thermalhydraulics (separate & integral effects), neutronics, component/feature, severe accident & containment
- Through a template, participating facilities provided:
  - General and technical description,
  - Contact details,
  - Record of experiments and planned experiments
  - QA program and IP considerations.



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NEXSHARE – First Workshop

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First Workshop (18-21 June 2024) **& launch of NEXSHARE:**

- ✓ Great example of collaboration between the IAEA, OECD/NEA and GIF.
- ✓ Discussed the different experimental testing and code validation programmes, industry and regulatory perspectives on code usage and validation for SMRs, and potential for collaborations.
- ✓ Discussed the next steps for the Network

Join the Network !

Next Steps – 2025-2027

Now that the Network is established, the next phase will focus on expanding the network, add functionalities and launch technology-specific collaborative work under the umbrella of NEXSHARE.

NEXSHARE Phase 2

International Collaboration

- ✓ Continue alignment with international organizations and projects.
- ✓ More organizations to join for increased international collaboration.

Network Expansion

- ✓ Continue to populate the Network and its database.
- ✓ Consolidation with existing IAEA databases.
- ✓ Add functionalities to further facilitate access and sharing of experiments.

Technology-Specific Work

- ✓ Form working groups to produce technology-specific deliverables.
- ✓ Detailed workplans under definition based on industry needs.

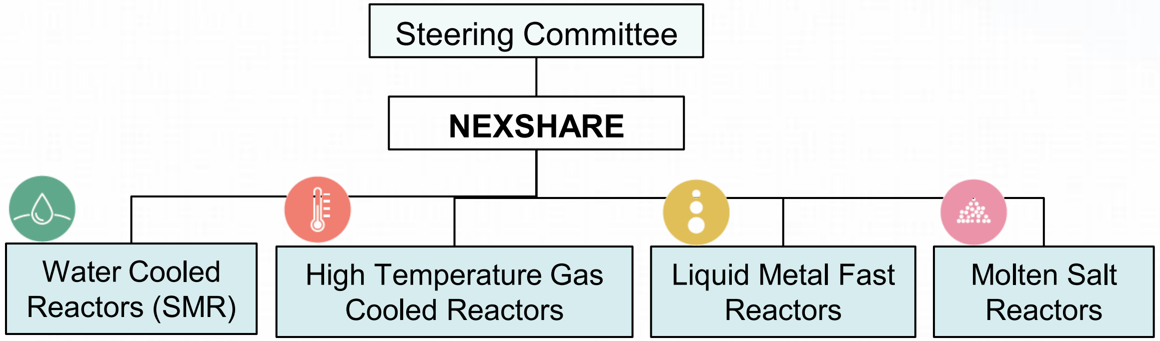
Information Sharing

- ✓ Articles in journals and conferences, webinars.
- ✓ 2nd NEXSHARE Workshop planned in 2026.
- ✓ More details on ongoing international projects.

NEXSHARE – 2025-2027

Network Enhancements:

- Visual and functional improvements
- Enhanced search capabilities in the database (e.g. per phenomena)
- Inclusion of decommissioned facilities
- Report generation & performance metrics
- Workflows for maintenance and upgrade



Launch of Focus Groups (FGs):

FGs were launched on 17 June through a Steering Committee meeting.

Scope:

- Expand the database and merge with existing ones (LMFNS, SANIS, HTGR DB) ** priority
- Review relevant work from International Organization, and identify priorities for the technology
- At least one webinar and working paper per group on industry priorities
- Strong collaboration with GIF, NEA & EC -> find synergies between the different ongoing projects

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NEXSHARE – Timeline for Phase 2

Steering Committee – General Scope

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- ✓ Finalize Phase II Plan
- ✓ Specifications for network improvements and new functionalities

- ✓ Webinar(s) and meetings on Experiments and code validation
- ✓ Publications
- ✓ Implementation of upgrades and new features.
- ✓ Steering Committee oversight meetings

2025

FG Launch

Webinar

Network Improvements

2026

Publications
DB merge and updates completed

Workshop

2027

Technology-specific Focus Groups

- ✓ Definition the scope and plan for each Focus Group
- ✓ Call for interest
- ✓ Launch Focus Groups

- ✓ Update Database and merge with existing ones (if applicable)
- ✓ Technology-specific work and publications
- ✓ Focussed webinars and meetings
- ✓ Collaboration & synergies with GIF, NEA, EC

NEXSHARE – Content of the LMFR Focus Group

Team: Nicole Virgili (IAEA), Vladimir Kriventsev (IAEA), Mariano Tarantino (ENEA), LMFNS Experts (under the umbrella of the TWG-FR)

General Scope

International collaboration
Prepare a working paper and webinar summarizing relevant work by International Organizations and incorporate the findings in the Network

LMFNS database Update
Harmonise with existing databases, update templates, facility contact points and operating data and connect it to NEXSHARE.

R&D needs and Tools
Develop a working paper and webinar on R&D needs for liquid metal-cooled reactors and status of numerical tools validation

Next Steps
Propose future experiments and code validation activities for LMFRs.

Deliverable	Date/Status
LMFR template agreed on.	June 2025
Contact points updated	Q3 2025
Populate the template with LMNS facilities. Concurrence granted and Information on facilities uploaded in the databases	Q4 2026

Conclusions

- **Share information on existing experimental programs. Identify potentials for resource sharing and synergies.**
- **Provide greater reach and enhanced utilization of existing experimental facilities.**
- Provide greater confidence on data and codes used in safety cases.
- Reduce costs and increase schedule certainty of experiments and code validation needed for SMRs.

Phase 1 (2023-2024)

Phase 2 (2025-2026)

To support the industry with an initiative that contributes to providing greater confidence in data and computer codes used in safety cases for global deployment of SMR and Advanced Reactors, the IAEA is:

- ✓ Setting up the NEXSHARE Network,
- ✓ Populating a database of experimental facilities for SMRs & Advanced Reactors,
- ✓ Collaborating with NEA, GIF, EC
- ✓ Initiating technology specific focus groups,
- ✓ Organizing events and providing opportunity to define collaborations.

Join the Network !

The meeting participants are welcome to:

- ✓ Provide their comments/suggestion for the LMFR Focus Groups work in NEXSHARE.
- ✓ Join the Network and participate to its events!

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NEA NUCLEAR ENERGY AGENCY

European Commission

GEN IV International Forum
Expertise | Collaboration | Excellence

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Acknowledgments

IAEA would like to express sincere gratitude to OECD Nuclear Energy Agency (NEA) and the Generation IV International Forum (GIF) for their invaluable contributions. We also wish to extend our special thanks to the organizations involved in the NHSI working group on Experiments and Code Validation and in the NEXSHARE Steering Committee for supporting the initiative with their participating members' leadership, guidance, and dedication. Their collective expertise and commitment have played a crucial role in the progress of this endeavor and in particular to the establishment of NEXSHARE.

The members of NEXSHARE Steering Committee are: Adorni, M. (NEA), Bae, H. (KAERI, Republic of Korea), Brunett, A. (ANL, USA), Grosjean, B. (CEA, France), Gimenez, E. (CNEA, Argentina), Hummel, D. (GIF), Iorizzo A. (European Commission), Kang, K.-H. (KAERI, Republic of Korea), Morreale, A. (CNL, Canada), Okano, Y. (JAEA, Japan), Qin S. (INL, USA) Ramsden, A. (Rolls Royse SMR, UK), Sabharwall, P. (INL, USA), Song, D. (CNNC/NPIC, China), Tarantino, M. (ENEA, Italy), Virdis, S. (TÜV NORD, Germany), Zhurbenko, E. (Rosatom, Russian Federation).

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LMFNS Experimental Facilities Catalogue

Experimental Facilities in support of Development and Deployment of Liquid Metal cooled Fast Neutron Systems

Includes an overview as well as detailed information on **153** experimental facilities under design, construction or operation

19 institutions from 14 IAEA Member States contributed

Freely Available at iaea.org: Search for "IAEA LMFNS"

- A comprehensive Catalogue providing detailed information on experimental facilities currently designed, under construction or operating
- Facilities Designed to support the development and deployment of innovative liquid metal-cooled (sodium, lead and lead-bismuth) fast neutron systems (LMFNS), both critical and subcritical
- Identifies existing or future operational experimental facilities able to support innovative LMFNS
- Expected to facilitate cooperation using existing and planned experimental facilities for LMFNS, and enhance their utilization by providing end-users with detailed information
- Encourages international collaborations

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NEXSHARE – What is the LMFNS database?

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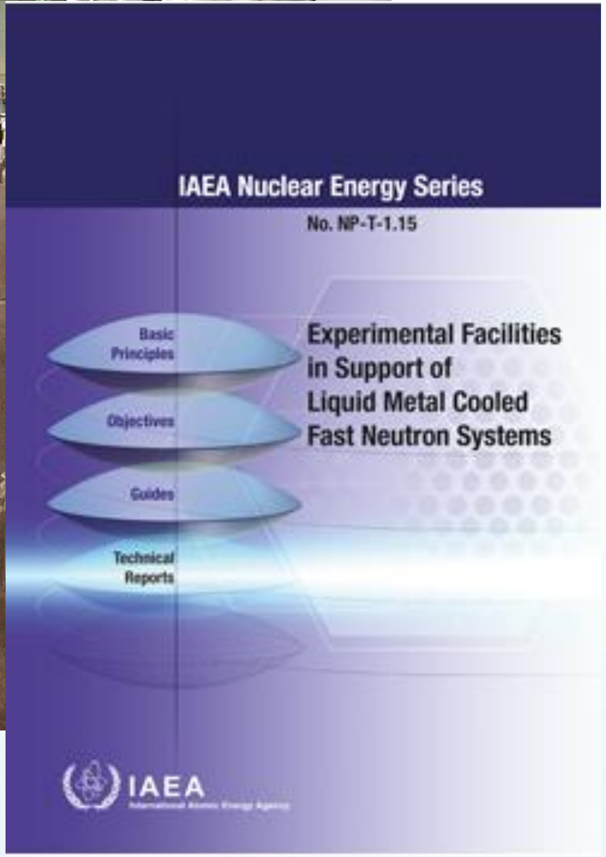
IAEA NES Publication: Experimental Facilities in Support of Liquid Metal Cooled Fast Neutron Systems

6B: IPPE, Russia



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- Inputs received from 14 countries and EU
- 153 facilities reviewed and accepted:
  - Na-based facilities: 79
    Pb-based facilities: 74
- NES document – 50 pages overview and ~1000 pages on CD
  - published in 2018
  - online since 2016
  - main upgrade in 2019
  - last updated in 2024; +2 from UK:
    - Versatile Loop Facility (VLF)
    - Passive Heat Removal Facility (PHRF)