



IAEA

International Atomic Energy Agency
Atoms for Peace and Development

Informal Webinar for the IAEA TWG-SMR members

SMR activities in NPTDS

Frederik Reitsma

Team Leader (SMR Technology Development)
Nuclear Power Technology Development Section
Division of Nuclear Power, Department of Nuclear Energy

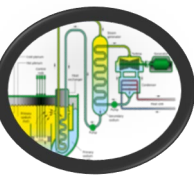
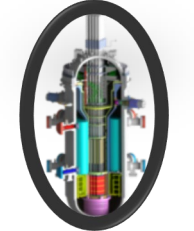
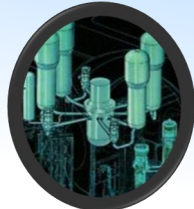
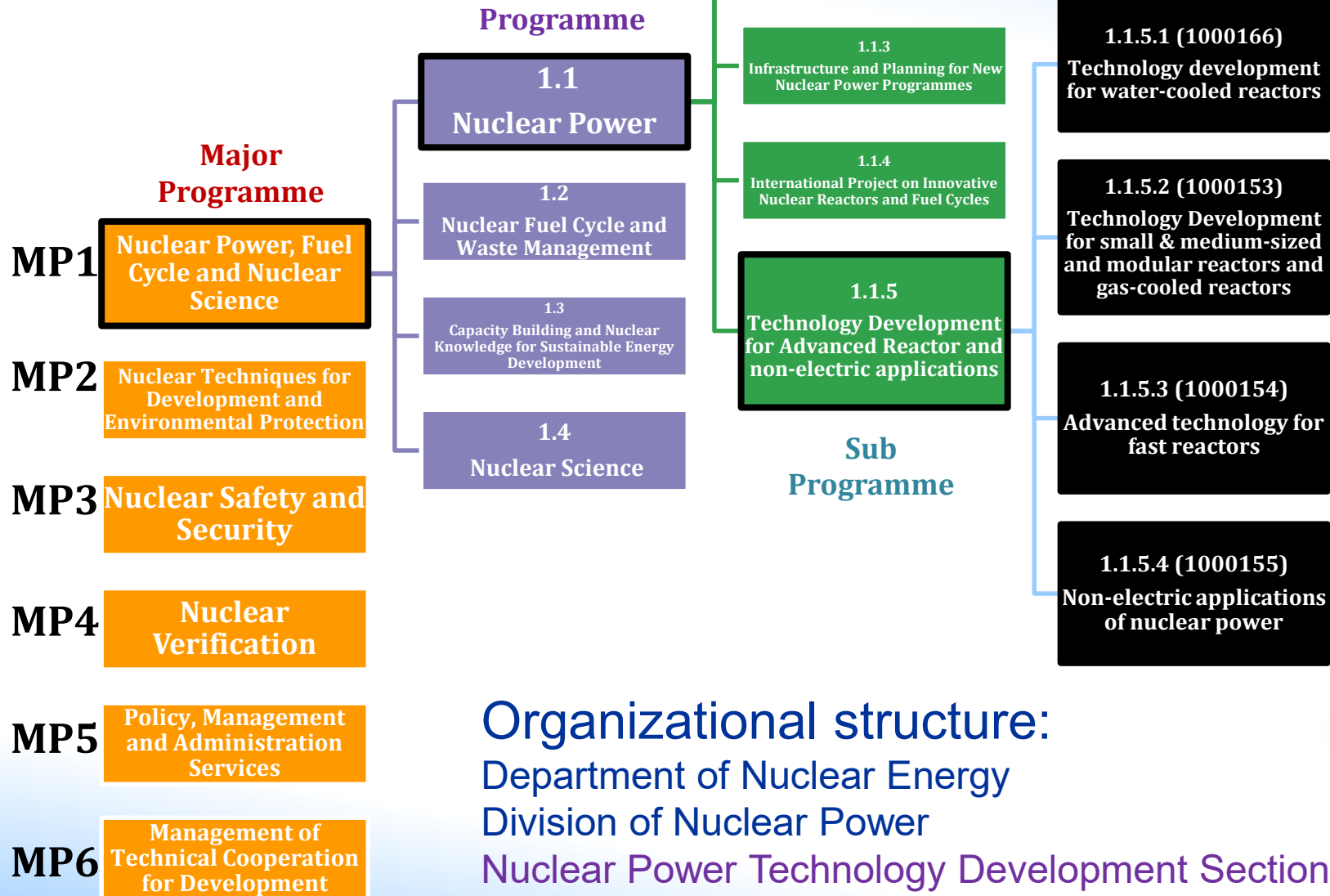
Nuclear Energy

Nuclear power, fuel cycle and waste management



The Department fosters the efficient and safe use of nuclear power by *supporting* existing and new nuclear programmes around the world, *catalysing* innovation and *building* indigenous capability in energy planning, analysis, and nuclear information and knowledge.

IAEA Programmatic Activities



Organizational structure:
 Department of Nuclear Energy
 Division of Nuclear Power
 Nuclear Power Technology Development Section

Nuclear Power Technology Development Section

Division of Nuclear Power

Department of Nuclear Energy



4 Sections

Division of Nuclear Power

Nuclear Power Engineering Section

The Section supports countries operating nuclear power plants or expanding their existing programmes to improve engineering, performance, management systems, human resource management, stakeholder involvement and technical infrastructure. It shares best engineering practices and innovations consistent with the global objectives of nuclear safety, security and non-proliferation. [Read more →](#)

Nuclear Power Technology Development Section

Fostering information exchange and collaborative research and development for advanced nuclear reactor technologies, this Section provides information to the IAEA's Member States on technology status and development trends for advanced reactor systems and their applications. [Read more →](#)

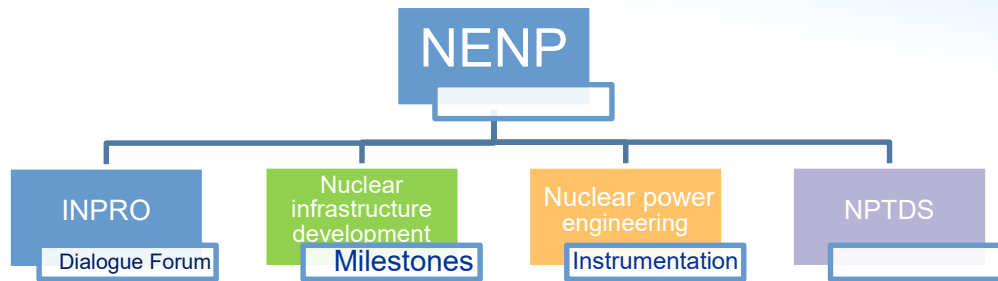
Nuclear Infrastructure Development Section

This Section is responsible for coordinating IAEA assistance to Member States considering or embarking on nuclear power programmes. It supports capacity-building, conducts review missions and offers guidelines, standards and workshops on developing the infrastructure for a safe, secure and sustainable nuclear power programme. [Read more →](#)

International Project on Innovative Nuclear Reactors and Fuel Cycles Section

The Section coordinates the activities of the membership-based International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) to increase international cooperation on global nuclear energy sustainability, long term strategies and institutional and technical innovations for nuclear energy **4** development and deployment. [Read more →](#)

SMR activities across NENP



NIDS: Milestones approach for SMRs

- TM on the Application of the IAEA Integrated Nuclear Infrastructure Review Methodology for SMRs, 27-20 Nov 2020
- Plan to develop specific considerations on the application of the milestone approach to SMR

INPRO:

- **Transportable Nuclear Power Plants:**
 - NES NG-T-3.5 Legal and Institutional Issues of TNPPs: A preliminary Study
 - TECDOC Case Study for the Deployment of a Factory Fuelled SMR
- **Dialogue Forum (DF) 17 on “Opportunities and Challenges in Small Modular Reactors”**
 - Ulsan, Republic of Korea, Jul 2019
 - Some 140 participants

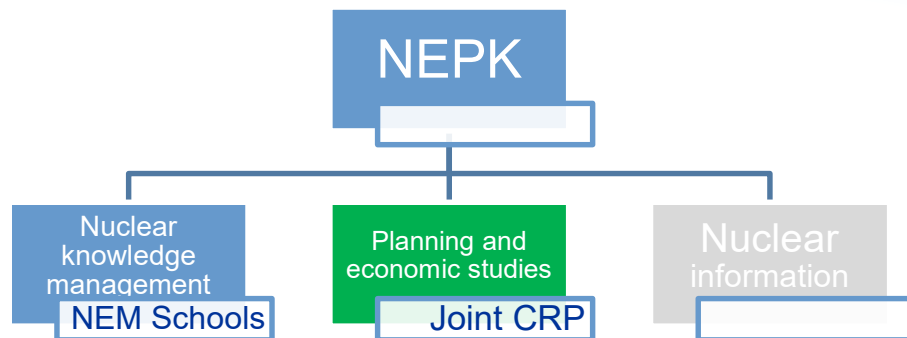
NPES: SMR Instrumentation and Control (I&C) System

- NES NP-T-3.19 Instrumentation and Control Systems for Advanced Small Modular Reactors

NPTDS: Presentation to follow and details in next presentation



SMR activities across NEPK

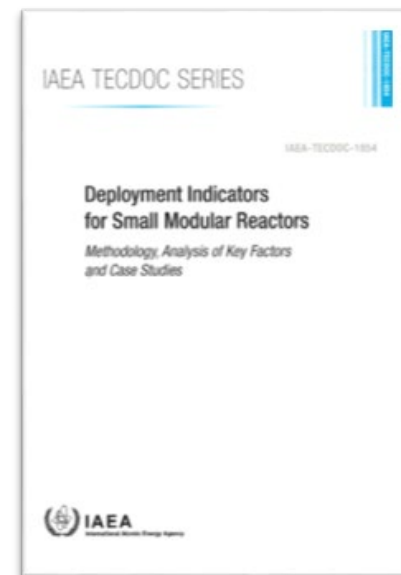


NKMS:

- SMRs and Advanced reactors regularly part of NEM Schools

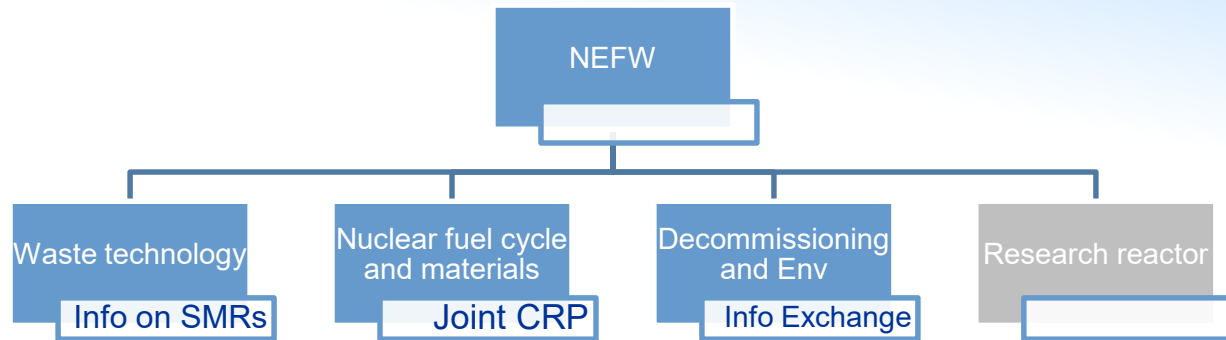
PESS:

- CRP on Economic Appraisal of SMR Projects: Methodology and Applications – in cooperation with NPTDS (12/2020 – 12/2023):
 - Aims at providing MS with a framework for the economic appraisal of SMR development and deployment;
 - Issues covered: SMR economic competitiveness vs non-nuclear; market research; cost-benefit analysis; financing key metrics and LCOE
 - Close cooperation in TC Europe RER2017 (see later)



Jointly developed with NPTDS

SMR activities with NEFW

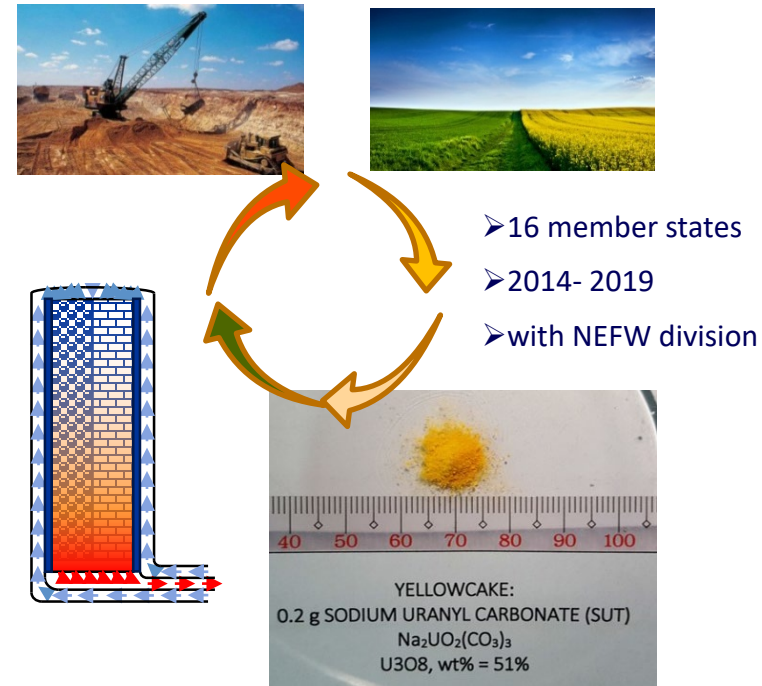


NEFW / Nuclear Fuel Cycle and Materials

- Added fields on fuel cycles and decommissioning plans in the Booklet
- Jointly implemented TC projects (HTGR fuel and waste)
- Advanced in designs and technology of nuclear fuels for integral-PWR type SMRs

CRP: HTGRs applications for energy neutral sustainable comprehensive extraction and mineral products development

Increased sustainability of ores and extraction processes while cleaning products and waste



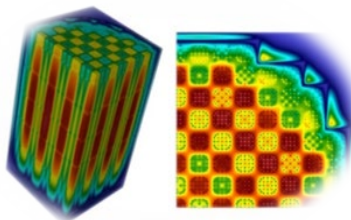
CRP completed - TECDOC being finalized

Macro Areas for Each Reactor Line and Non-Electric Applications

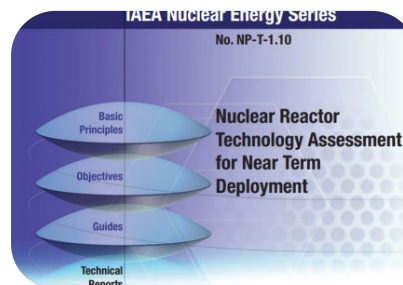
Assist MSs with national nuclear programmes; Support innovations in nuclear power deployment; Facilitate and assist international R&D collaborations



Information Exchange



Modelling and Simulations



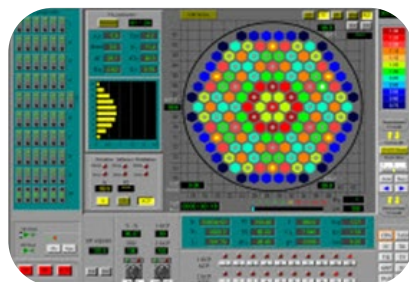
Development of Methodologies



Safety - Technology



Technology Support



Education and Training



Knowledge Preservation



Tool-kits

IAEA Tools for delivery



- Reference technical documents
- Technical meetings, thematic conferences, cooperation meetings, GC side events
- Peer Review, Advisory and Expert Missions
- Coordinated Research Projects (CRPs)
- Collaborating Centres (EPFL-Switzerland, PIAES-Pakistan, INSTN-France, Ontario Tech University-Canada)
- Training courses and Workshops
- Fellowships and Scientific Visits
- E-learning material, distant learning, topical and programmatic web-platforms
- Coalitions and networks, including web-based
- Databases and information systems (e.g. ARIS)
- Procurement of products and services

Webinar Series on Nuclear Technology Breakthroughs for the 21st Century



Nuclear-Renewable Integrated Energy Systems: Prospects and Issues
Webinar Series on Integrated Energy Systems for Electricity Production and Beyond

June 24th, 2020
15:00 – 16:00
CET (Berlin, GMT +02:00)

Organized by:

Dr. Tatjana Jevremovic
Team Leader, Water Cooled Reactors, IAEA

Speakers:

Dr. Shannon Bragg-Sittler
Integrated Energy Systems (IES) Lead
Nuclear Sciences & Technology
Idaho National Laboratory, USA

Dr. Kamil Tucek
Team Leader
Joint Research Centre
European Commission

Dr. Matthias Krause
Nuclear Engineer, Water Cooled Reactors
International Atomic Energy Agency

Conducted:
400 participants
50 country

Cogeneration: Nuclear Energy Beyond Electricity Production
Webinar Series on Nuclear Technology Breakthroughs for the 21st Century

22 July 2020
15:00-16:00 CET (Berlin, GMT +02:00)

Speakers:

Dr. Gina Strati
Director, Energy Program
Research & Development
Canadian Nuclear Laboratories

Dr. Yan Xinglong
Deputy Director, Sector of Fast Reactor and Advanced Reactor R&D
Japan Atomic Energy Agency

Dr. Ibrahim Khamis
Team Leader, Non-Electric Applications
International Atomic Energy Agency

Moderator:

Small Modular Reactors in Integrated Energy Systems
Webinar Series on Nuclear Technology Breakthroughs for the 21st Century

09 July 2020
15:00-16:00 CET (Berlin, GMT +02:00)

Speakers:

Muhammad Aamir
Manager, SMR Design
Ontario Power Generation
Canada

Giorgio Locatelli
Chair in Project Business Strategy
School of Civil Engineering
University of Leeds, UK

Frederik Reitsma
Team Leader, SMR
International Atomic Energy Agency

Moderator:

Conducted:
333 registrants
44 country

Molten Salt Reactors: A Game Changer in the Nuclear Industry
Webinar Series on Nuclear Technology Breakthroughs for the 21st Century

27 August 2020
14:00-15:00 CET (Berlin, GMT +02:00)

Speakers:

Elsa Merle
Grenoble Institute of Technology
CNR3-IN2P3-LPSC, France

David Holcomb
Oak Ridge National Laboratory (ORNL)
USA

Gerardo Martinez-Guridi
Nuclear Power Technology Development
IAEA

Moderator:

Conducted:
530 registrants
67 country

www.iaea.org/nptd-webinars

Small Modular Reactors in integrated Systems



Small Modular Reactors in Integrated Energy Systems

Webinar Series on Nuclear Technology Breakthroughs
for the 21st Century

09 July 2020

15:00-16:00 CET (Berlin, GMT +02:00)

Speakers:



Muhammad Aamir
Manager, SMR Design
Ontario Power Generation
Canada



Giorgio Locatelli
Chair in Project Business Strategy
School of Civil Engineering
University of Leeds, UK

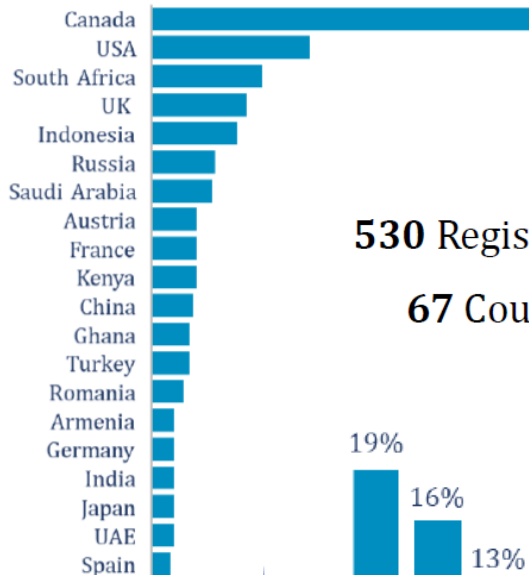
Moderator:



Frederik Reitsma
Team Leader, SMR
International Atomic Energy Agency



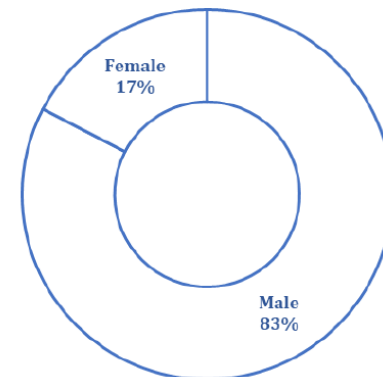
Webinar in Numbers



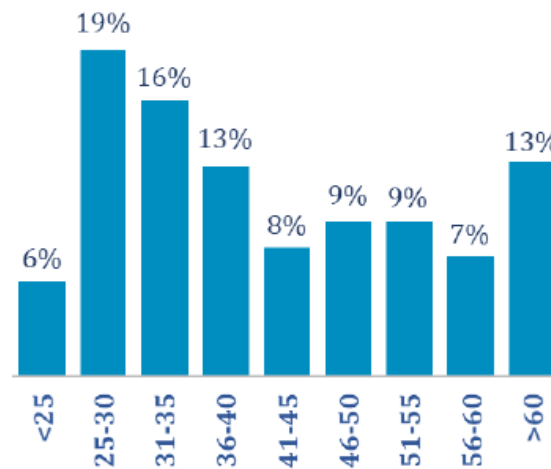
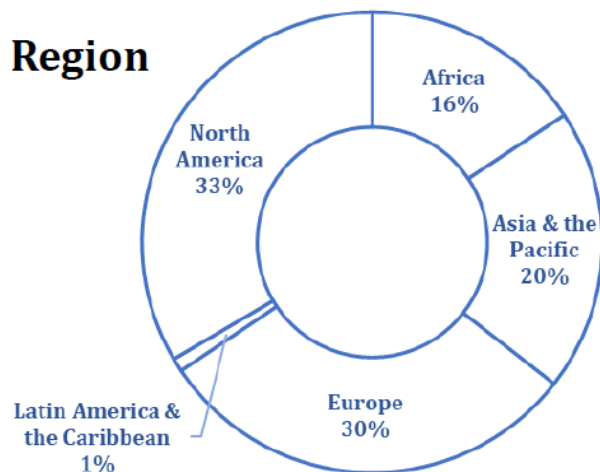
530 Registrants

67 Countries

Gender



Region



Coordination with the other Technical Departments:



- NE-NS Coordination Group on SMR:
 - Joint meetings and conferences (*Topical Issues in Nuclear Installation Safety*)
 - Joint CRPs (e.g. EPZ)
 - Joint technical support to TC projects
 - Cross review of technical documents
 - The case of TNPPs (joint briefing to MS)
- Participation to the Safeguard-by-Design WG of the Department of Safeguard
- TCEU regional project on SMR: **to become interregional in 2022-23**

Coordination with Other International Organizations:

- OECD-NEA
- EC/JRC
- IFNEC
- Generation IV International Forum
- NICE Initiative



IAEA

International Atomic Energy Agency
Atoms for Peace and Development



IAEA NPTDS Activities

- **The NPTDS SMR team**
- **Main products**
- **Coordinated research projects**
- **Publications**
- **Planned activities**

NPTDS – Nuclear Power Technology Development Section

STAFF

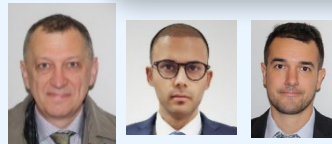
Section
Head



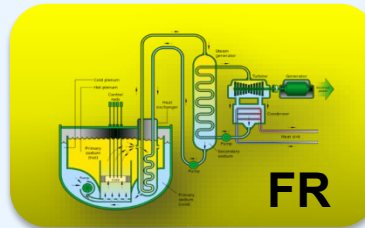
Section
Teams'
Assistants



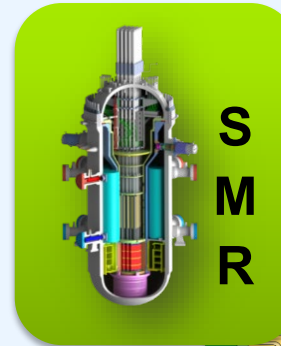
WCR



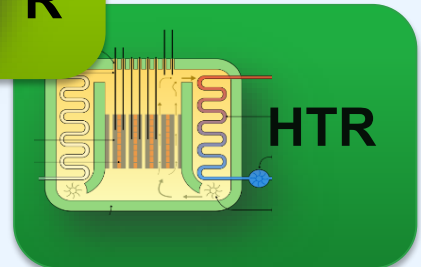
FR



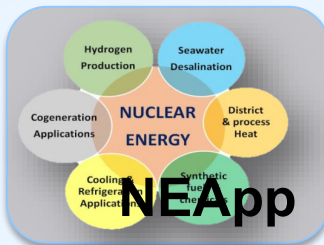
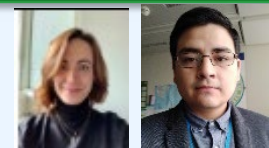
S
M
R



HTR



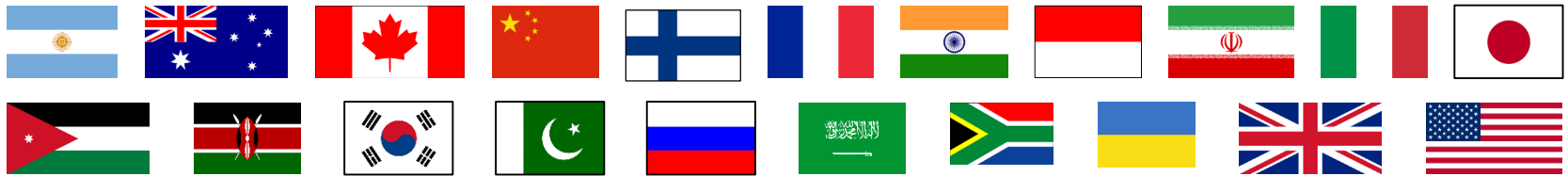
SMR team:
2 Regular Staff
1 CFE US
1 JPO France
1 Intern



International Technical Working Group on SMR

- To advice and support IAEA programmatic planning and implementation in areas related to technology development, design, deployment and economics of SMRs
- 1st meeting in 2018 with 14 Member States

- **Now 21 Member States** and two International Organizations: European Commission and OECD-NEA as invited observers:



- Recent additions: Finland and Morocco (observer)
- Three technical subgroups established in 2018:
 - **SG-1:** Development of Generic Users Requirements and Criteria (GURC)
 - **SG-2:** Research, Technology Development and Innovation; Codes and Standards
 - **SG-3:** Industrialization, design engineering, testing, manufacturing, supply chain, and construction technology
- TWG will also address SMR for Non-Electric Applications and coupling with renewables
 - 1st TWG Meeting for SMR held on 23 - 26 April 2018 in Vienna
 - 2nd Meeting : 8 – 11 July 2019 in Vienna
- 3rd meeting, Scheduled for 31 August – 2 September 2020 in Vienna – **POSTPONED to September 2021**
- **This WebEx session for information sharing**
- <https://nucleus.iaea.org/sites/htgr-kb/twg-smr/SitePages/Home.aspx>

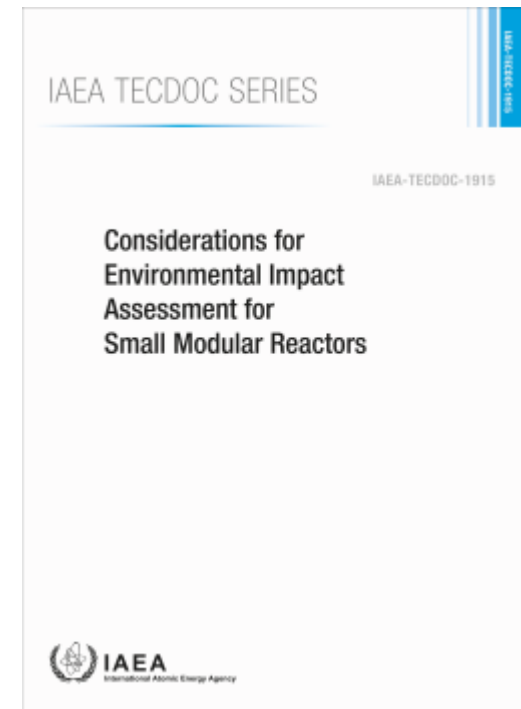
TECDOC “Considerations for Environmental Impact Assessment (EIA) for SMRs”



P
U
B
L
I
S
H
E
D

- The IAEA offers two publications providing guidance and information for performing non-radiological and radiological EIAs, and assist in developing an effective assessment process for large nuclear power plants (NPPs):
 - Managing Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programmes, NG-T-3.11, 2014.
 - Prospective Radiological Environmental Impact Assessment for Facilities and Activities, GSG-10, 2018.
- **IAEA-TECDOC-1915, published in June 2020, currently may be used in addition to these two IAEA publications to support early SMR deployment.**

<https://www.iaea.org/publications/14676/considerations-for-environmental-impact-assessment-for-small-modular-reactors>



IAEA ARIS database include SMR designs



IAEA ARIS Advanced Reactors Information System

Technical Data

Characteristics

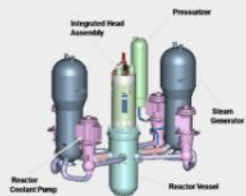
Publications

Glossary

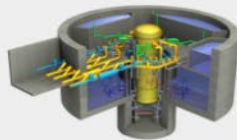
About ARIS

ADVANCED REACTORS

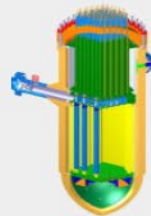
WATER COOLED TECHNOLOGY



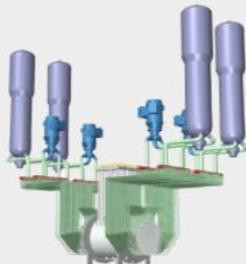
PWR



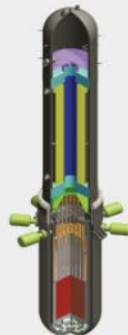
BWR



SCWR

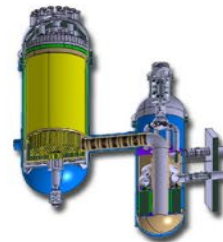


HWR

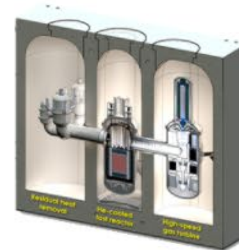


iPWR

GAS COOLED TECHNOLOGY

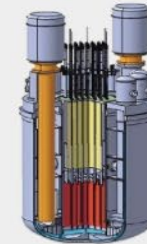


GCR

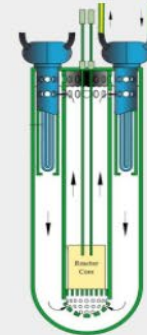


GFR

MOLTEN METAL COOLED TECHNOLOGY

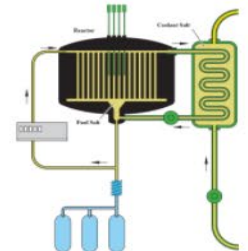


SFR

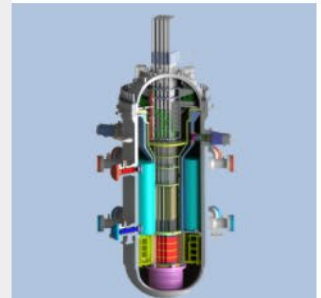


LFR

MOLTEN SALT COOLED TECHNOLOGY



MSR



SMR

Advanced Reactors Information System

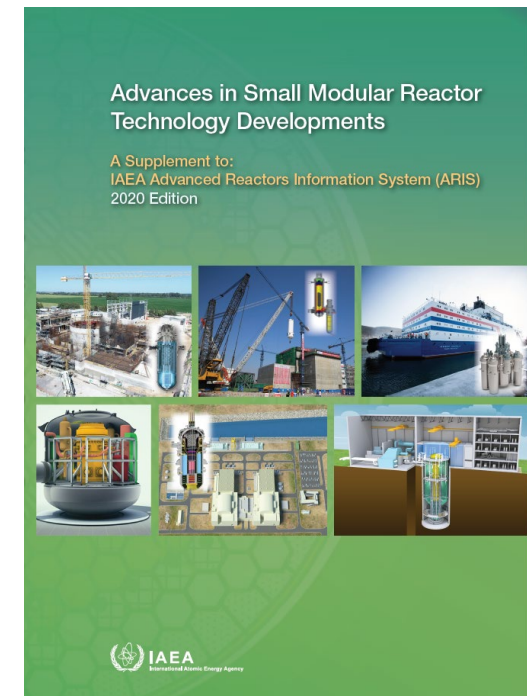
Submissions made by vendors / design organizations, often small startup companies

11 SMR design updated in ARIS in JULY 2020

Updating IAEA SMR Booklet 2020 and ARIS

- The booklet contains information provided by vendors and designers on their SMRs
- Main Features
 - Design description and main features of **72** SMR designs being updated (we had 56 in 2018)
 - Also requested information on fuel cycle, decommissioning and final disposal (for the first time)
 - SMRs are categorized in types based on coolant type/neutron spectrum:
 - Land Based WCRs
 - Marine Based WCRs
 - HTGRs
 - Fast Reactors
 - MSRs
 - **Micro reactors**
 - **Test reactors (to be included with the types above as applicable)**
 - MANY designs not included / not submitted and thus not included in IAEA reporting
 - Content to be finalized this week
 - Printing date 3 September

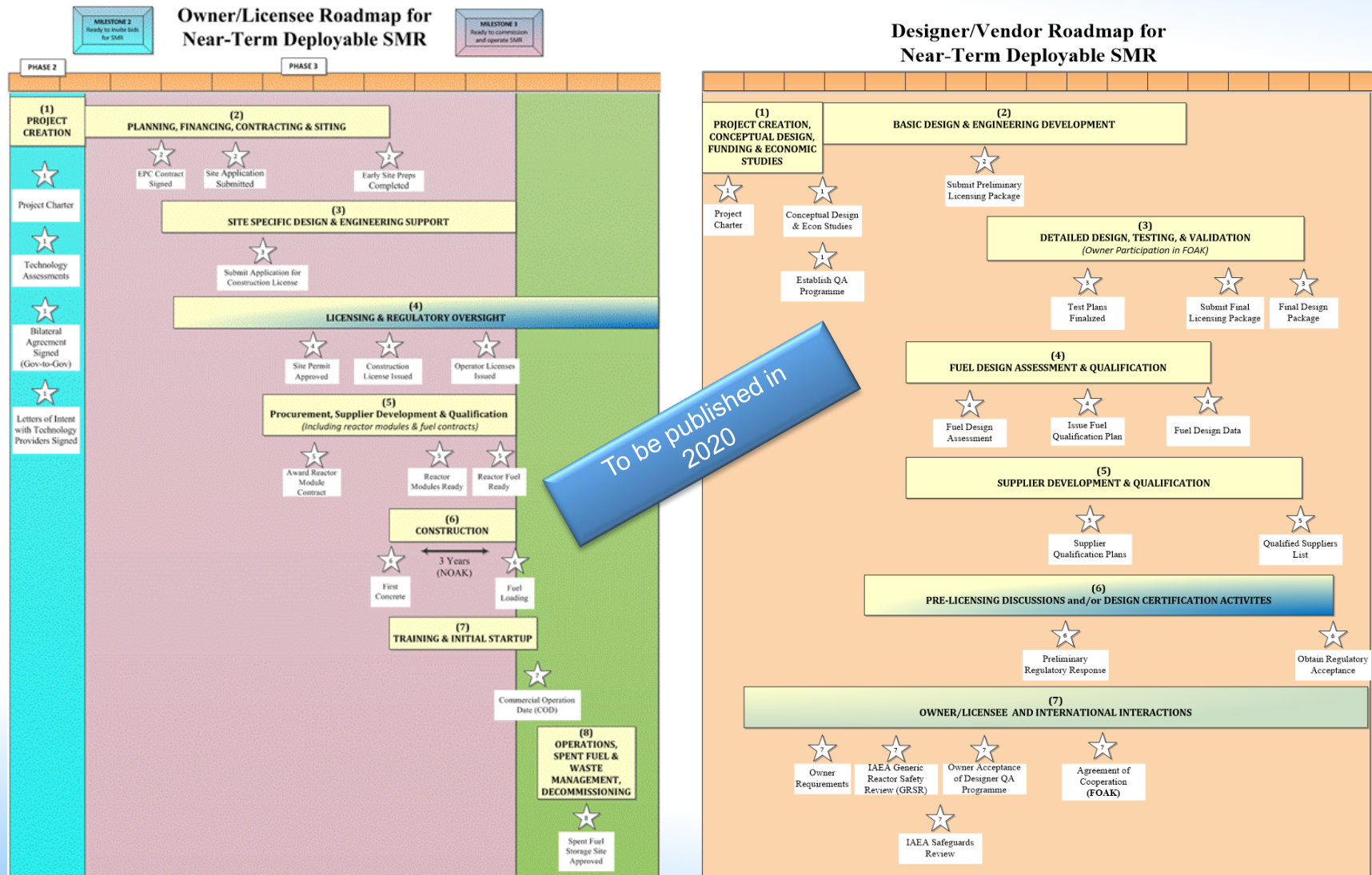
2020 Edition



Technology Roadmap for SMR Deployment

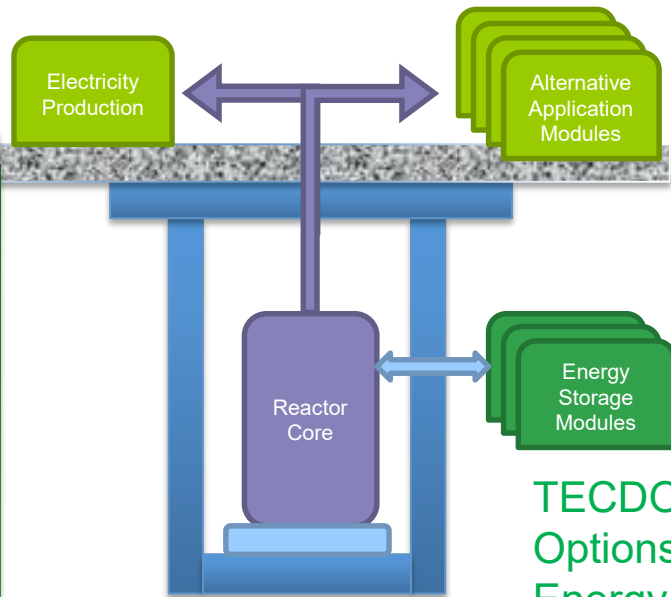
IAEA

In response to Member States need on **Rational Roadmap** of global development and deployment pathways of SMR design and technology



TECDOC: Role of SMRs in Climate Change

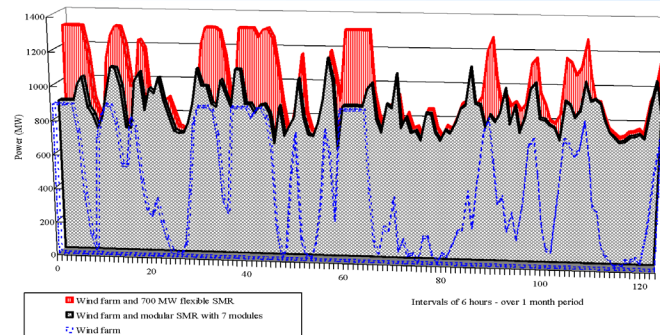
SMR Renewables Hybrid Energy System to Reduce GHG Emission



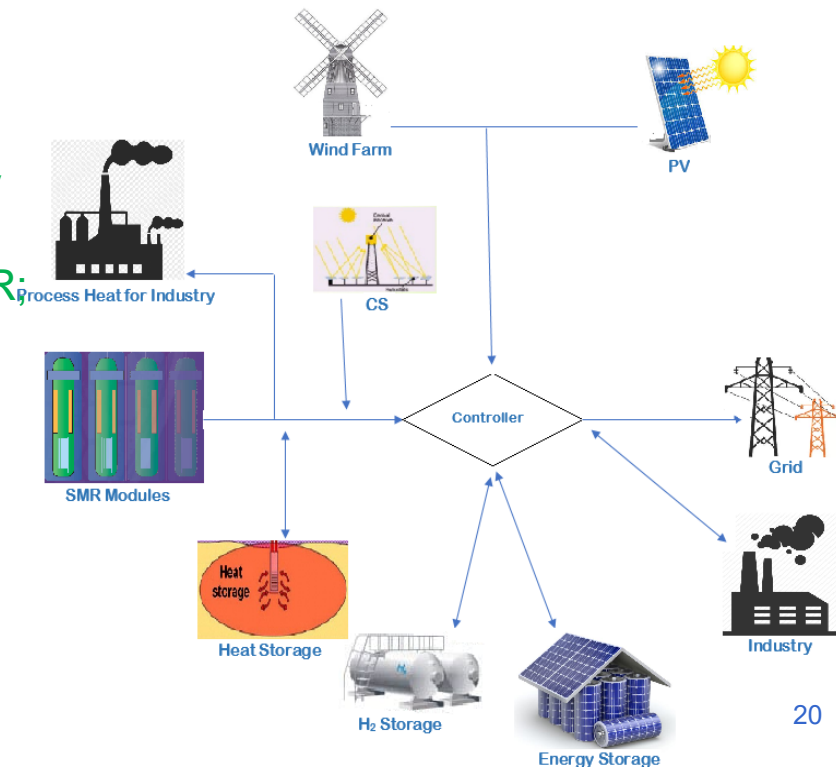
TECDOC:
Options to Enhance
Energy Supply Security
using Hybrid Energy
Systems based on SMR;
being finalised in 2020

Modules:

- Electricity production
- Process heat
 - Petro-chemical industry
 - Desalination plant
 - Oil and gas reforming
 - Hydrogen production
 - Ammonia production
 - District heating / cooling
 - Waste reforming
- Energy storage
- Load follow capabilities
 - Switch between applications



Example of load follow with renewables



Forthcoming HTGR Publications



- TECDOC: Description of benchmark experiments at the ASTRA facility on the definition of the spatial distribution of ^{235}U fission reaction rates
- TECDOC: Improving the Understanding of Irradiation Creep Behaviour in Nuclear Graphite Part 1: Models and Mechanisms (Final report of a coordinated research project)
- TECDOC: Discussion of Nuclear-Grade Graphite Oxidation in Modular High Temperature Gas-Cooled Reactors
- TECDOC: High Temperature Reactor Application for Mineral Processing: Final report of a coordinated research project: 2015–2018
- To be combined again after agreement with NSNI (CRP outcome):
 - NES: Modular High Temperature Gas-cooled Reactor Safety Design Criteria
 - TECDOC: Modular High Temperature Gas-cooled Reactor Safety Design Methodology and Implementation Examples (Final report of a coordinated research project)

2021:

- TECDOC: High Temperature Gas Cooled Reactor Physics, Thermal-Hydraulics and Depletion Uncertainty Analysis (Final report of a coordinated research project)
- TECDOC: Performance Evaluation of German Mixed Thorium-Uranium and Uranium Oxide TRISO Fuels

TECDOC on the Status of Molten Salt Reactor (MSR) Technology

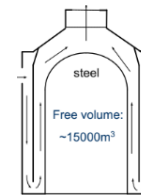
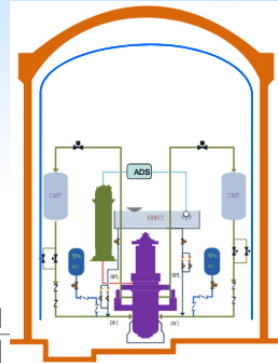


U
N
D
E
R

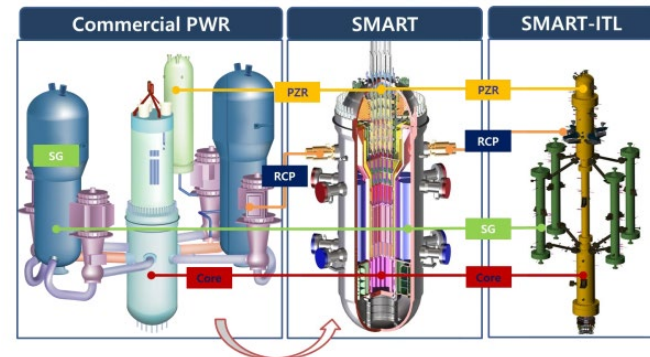
D
E
V
E
L
O
P
M
E
N
T

- It summarises the state-of-the-art knowledge on the status of research, technological developments, and reactor concepts in the area of molten-salt-fuelled and molten-salt-cooled advanced reactors.
- A draft is being developed, and there will be a virtual meeting on this document in July, including members from the GIF Provisional System Steering Committee (pSSC) on MSRs.
- It is expected that it will be published in the next 6 to 12 months.

CRP I32010 Passive Engineered Safety Features in iPWRs

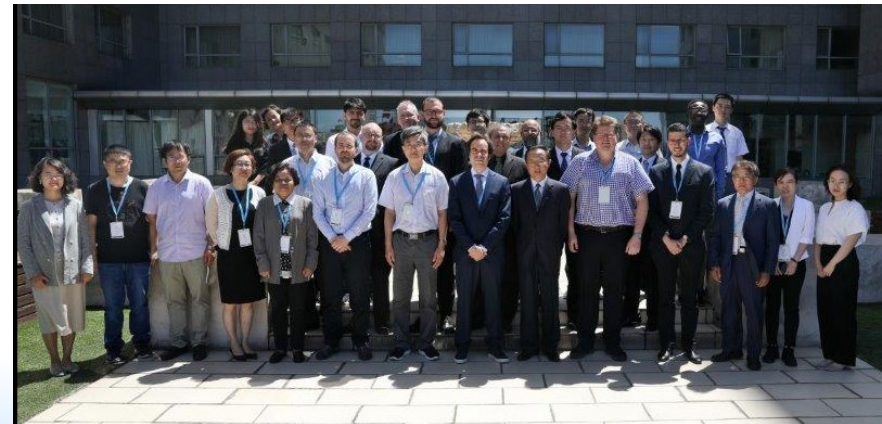
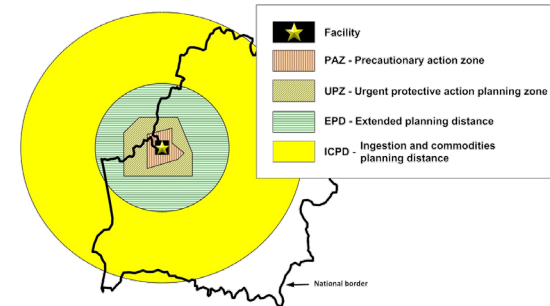


- Develop an approach for
 - designing passive engineered safety features for water-cooled SMRs and
 - offering good practices for assessing their performance and reliability
 - verification & validation methodologies
- Focus groups:
 - Passive Safety System Design and Technology Development
 - Approaches and Methods for Functional Reliability Assessment of Passive Systems
 - Experiments, Analysis and V&V
- 3 Year project from July 2017 until July 2020
 - Argentina, Canada, China, Egypt, India, Indonesia, Italy, Republic of Korea, Lithuania, Pakistan
- RCMs:
 - RCM1: 30 Oct – 3 Nov 2017
 - RCM2: 7 – 10 May 2018
 - RCM3: 3 - 6 September 2019, KAERI
 - RCM-4 delayed to 2021
- TECDOC draft under development



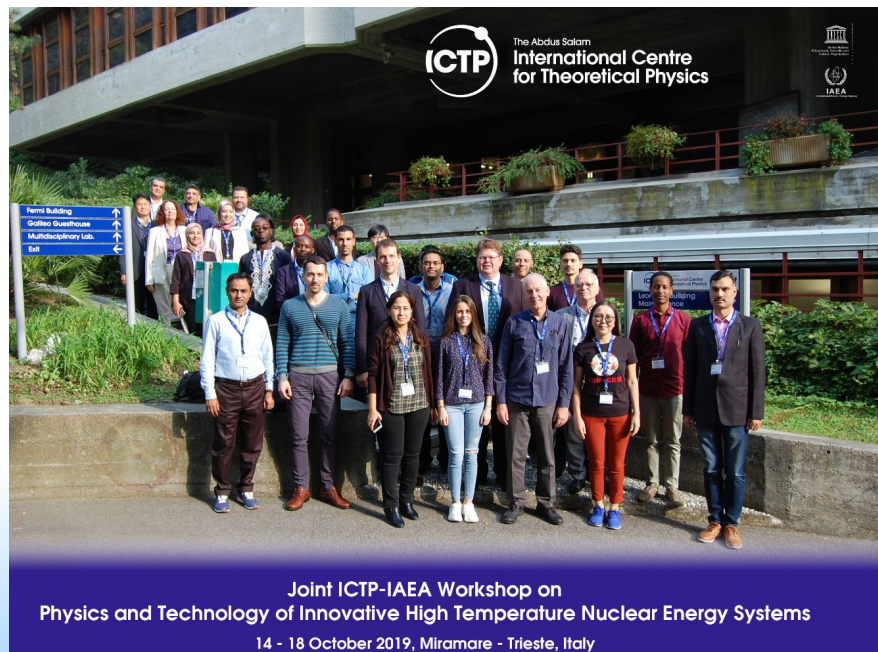
CRP I31029 Development of Approaches, Methodologies and Criteria for Determining the Technical Basis for Emergency Planning Zone for Small Modular Reactor Deployment

- Definition of consistent approaches, methodologies, criteria to determine need for off-site EPR, including EPZ/D size, for SMR deployment
- Includes identification of technology specific factors for different SMRs that may influence source term and timing of release possible sequences to be considered for emergency classification system
- Focus groups:
 - Passive Safety System Design and Technology Development
 - Approaches and Methods for Functional Reliability Assessment of Passive Systems
 - Experiments, Analysis and V&V
- 3 Year project from May 2018 until May 2021 (COVID-19 delays possible)
 - 20 participants from 14 MS
 - Argentina, Canada, China, Finland, Indonesia, Israel, Japan, Korea, Pakistan, Saudi Arabia, Tunisia, UK, USA, and EC
- RCMs:
 - RCM-1 took place May 14-17 2018
 - RCM-2 took place May 27-31 2019 in Beijing, China
 - VIRTUAL RCM-3 took place
 - Final RCM for
- TECDOC draft under development
- JOINT project with IEC and NSNI



ICTP-Trieste-2019

- The workshop covers several aspects related to High Temperature Reactors with focus on the state-of-the-art in technology, design concepts, cogeneration and nuclear heat applications. It includes scientific aspects such as reactor physics, thermal-fluids, analyses and simulation.



Joint ICTP-IAEA Workshop on the Physics and Technology of Innovative High Temperature Nuclear Energy Systems



14 - 18 October 2019
Trieste, Italy

Further information:
<http://indico.ictp.it/event/6725/>
sme3281@ictp.it

- Global scenarios for nuclear energy;
- Advances of SMRs and overview and status of HTR technologies;
- Non- electrical applications of nuclear energy;
- Safety characteristics and design philosophy;
- Core neutronics and thermal-fluid design features;
- Status of fuel development for HTRs for normal and accident conditions;
- Innovative primary components and availability of high temperature materials (graphite, structural materials, coolants, molten salt, and for hydrogen production facilities);
- Source terms evaluation, chemical form and transport phenomena;
- Uncertainties in analysis including uncertainties in cross section libraries;
- Use of software tools for Simulation, HTR analysis and Process Heat Applications.

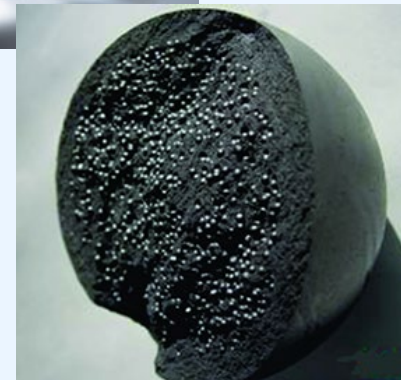
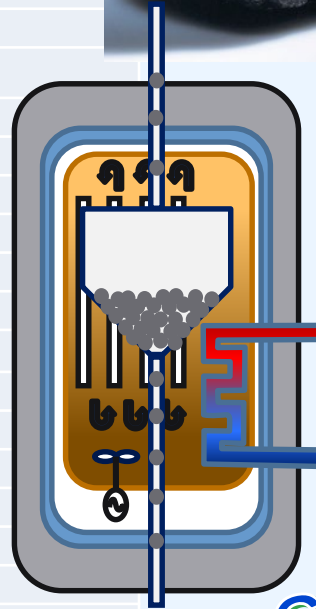
SMR E-Learning Courses

E-Learning planned and under development

- SMR
- 1 Introduction + history of LWRs
 - 2 Safety design Approach
 - 3 LWR Licensing
 - 4 Fuel
 - 5 Reactor design
 - 6 Reactor systems
 - 7 Material performance
 - 8 I&C ?



- HTR
- 1 Introduction + history of HTGRs
 - 2 Safety design Approach
 - 3 HTGR Licensing
 - 4 Graphite
 - 5 TRISO Fuel
 - 6 Prismatic HTGR
 - 7 Pebble bed HTGR
 - 8 Reactor systems
 - 9 HT material performance
 - 10 I&C ?
 - 11 Fission products behavior ?
 - 12 HTGR Accidents
 - 13 Accident analysis tool



Graphite in the core





IAEA

International Atomic Energy Agency

Atoms for Peace and Development

2020, 2021 Meeting plans & P&B 2022/23 main topics

2020 Meeting plan



Start Date	End Date	Event Country	Event Locations	Event Title	Event Owner
2020-02-03	2020-02-06	Austria	Vienna	Consultancy Meeting on the TECDOC on HTGR Reactor Physics, Thermal-Hydraulics and Depletion Uncertainty Analysis	Reitsma, Frederik
2020-07-08	2020-07-08	Austria	Vienna	Virtual Event 14th GIF-IAEA Interface Meeting	Reitsma, Frederik
2020-07-21	2020-07-23	Austria	Vienna	(Virtual Event) Consultancy Meeting on Developing the TECDOC on the Status of Molten Salt Reactor Technology	Martinez-Guridi,...
2020-08-03	2020-08-06	Austria	Vienna	(Virtual Event) Third Research Coordination Meeting on Development of Approaches, Methodologies and Criteria for Determining the Techni...	Reitsma, Frederik
2020-08-25	2020-08-25	Austria	Vienna	(Virtual Event) Consultancy Meeting on the Transfer of Research Centre Jülich HTR Knowledge Base and Codes to the IAEA	Reitsma, Frederik

Event Number	Event Quarter	Event Title
EVT1904139	5-6 Nov	Technical Meeting on the IAEA Nuclear Graphite Knowledge Base
EVT1907033	11-13 Nov	(Virtual Event) Consultancy Meeting on Development of Generic User Requirements and Criteria (GURC) on Small Modular Reactor Technology

- Many unknowns:
 - Meetings was postponed, again postponed, made virtual and cancelled...
 - The Agency had to put new procedures in place for virtual meetings
 - Unfortunately some meetings got changed / approved opr postponed on very short notice
- Webinars was introduded as new way to communicate with MS.
- Focus on publications and e-learning should bear fruit in foreseeable future

2021 Meeting plan (not official)

(Only to be approved in October, subject to requested reductions from DG office)



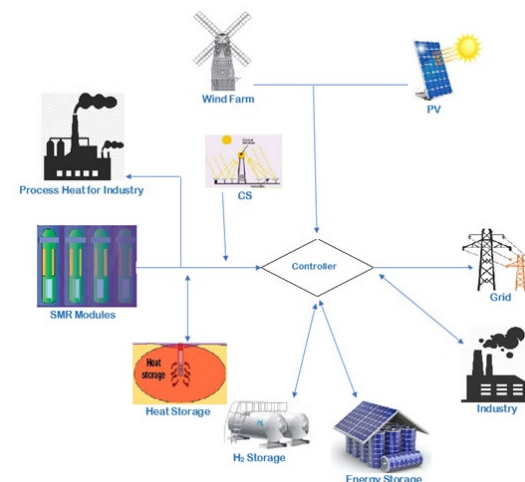
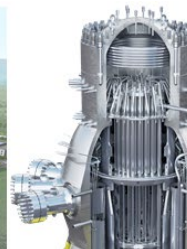
Event Number	Event Quarter	Event Title
EVT1903994	1	Postponed due to COVID-19: Fourth Research Coordination Meeting on Design and Performance Assessment of Passive Engineered Safety Features in Advanced Small Modular Reactors
EVT1904099	2	Postponed due to COVID-19: Technical Meeting on Generic User Requirements for Near Term Deployment of Small Modular Reactors
EVT2000098	2	Postponed due to COVID-19: Technical Meeting on the Status, Design Features, Technology Challenges and Deployment Models of Microreactors
EVT1904019	2	Fourth Research Coordination Meeting on Development of Approaches, Methodologies and Criteria for Determining the Technical Basis for Emergency Planning Zone for Small Modular Reactor Deployment
EVT1904023	3	Postponed due to COVID-19: Workshop on High Temperature Gas Cooled Reactor Technology (** if meeting is to be reduced – to be cancelled (ICTP event to address topic in future)
EVT1904101	3	Postponed due to COVID-19: First Research Coordination Meeting on Technologies to Enhance the Competitiveness and Early Deployment of Small Modular Reactors and High Temperature Reactors
EVT1904034	3	Meeting of the Technical Working Group on Gas Cooled Reactors (TWG-GCR)
EVT1904016	3	Postponed due to COVID-19: Third Meeting of the Technical Working Group on Small and Medium Sized or Modular Reactors
EVT1904029	3	Technical Meeting on the Status of the IAEA Nuclear Graphite Knowledge Base
EVT1904514	4	Postponed due to COVID-19: Second Joint IAEA–GIF Technical Meeting on the Safety of High Temperature Gas Cooled Reactors (**alternatively to be organised by NSNI)

New CRP: Technologies to enhance the competitiveness and early deployment of SMRs and HTRs



CRP-I3 2231 Technologies to Enhance the Competitiveness and Early Deployment of SMRs & HTRs (**Q2/2021 – 2024**);

Provides a forum for R&D with the objective to facilitate MS with the formulation of innovative solutions to make SMRs / HTRs more attractive viable option to diverse markets



The Coordinated Research Project will study **technologies related to reactor design and innovative power conversion of SMRs and HTRs to enhance the competitiveness and possibilities for deployment**

- This includes aspects such as reactor core and NPP designs for novel applications

Generic User Requirements and Criteria (GURC)



- Member States requested IAEA to provide support, guidance and capacity building on the development of their national generic user requirements and criteria (GURC) for SMR technology
- The GURC is to present
 - *expectations of user/owner/operator in Member States for their potential SMR nuclear plants;*
 - *a set of key policy, technical and economic requirements that will facilitate the embarking countries in conducting reactor technology assessment and eventually developing a tender document; and*
 - *a basis for designers and technology developers to come up with a certified reactor product that incorporates specific needs of embarking countries.*
- Identify specific issues associated with the need of SMRs for cogeneration of electricity and industrial process heat
- Consider key technology attributes of SMRs, including: plant outputs, design simplification, plant footprint, operational flexibility, incremental capacity, reliability, constructability, standardization, safety performance, creditworthiness and cost competitiveness;
- Discuss roadmap of national nuclear energy programmes in the Member States by highlighting electric utility requirements on SMRs design;
- Identify key differences between design requirements of reactor technology for regulatory/licensing purposes and generic requirements from users/owners' perspectives
- **The first year to focus on top-tier fundamental technology requirements, then will incorporate others such as safety, security and safeguards aspects in following years.**

Other highlights for P&B 2022/23

All still to be approved:

- New CRP on Microreactors (on PCF).
- NE Series report on General User Requirements of Developing Countries for Small and Medium-sized Reactors and their application
- Address specific Technology Aspects of SMR such as Design, Manufacturing Process and Technology Qualification of **Novel Components** for SMRs.
- ONCORE – Open source HTGR and SMR software (built on German FZJ transfer of code systems to IAEA)

Concluding Summary

- IAEA is engaged to support Member States in SMR Technology Development and Deployment
- SMR is an attractive option to enhance energy supply security
 - **In newcomer countries with smaller grids and less-developed infrastructure**
 - **In advanced countries for power supplies in remote areas and/or specific applications**
- Innovative SMR concepts have common technology development challenges, including regulatory and licensing frameworks
- Studies needed to evaluate the potential benefits of deploying SMRs in grid systems that contain large percentages of renewable energy.
- Studies needed to assess Generic User Requirements, Technology Readiness, Experimental Facility needs and Manufacturing aspects (codes and standards)



IAEA

International Atomic Energy Agency

Atoms for Peace and Development



Thank you!