IAEA
International Atomic Energy Agency
Atoms for Peace and Development

IAEA Activities on HTGR Technology Development

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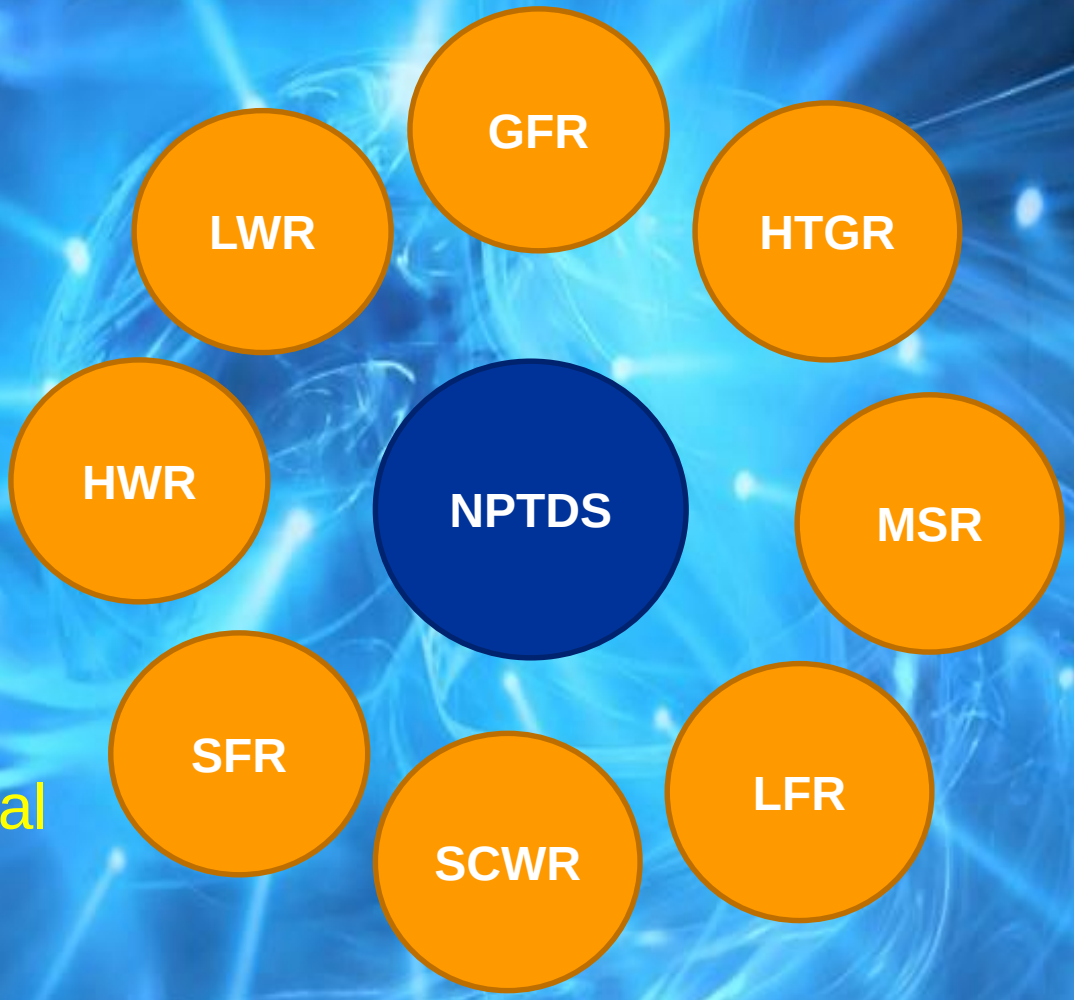
Nuclear Power Technology Development Section
Division of Nuclear Power, Department of Nuclear Energy

NPTDS

Nuclear Power Technology Development Section

- Department of Energy
- Division Nuclear Power
- NPTDS currently works on all advanced and innovative reactor technologies
- Provides support to member states on all issues related to technology
- Has a number of technical working group driving its work in order to implement the GC resolution



Programme Activities: TWGs, Conferences, CRPs, International Experts Meetings, TMs

Collaborating Centers

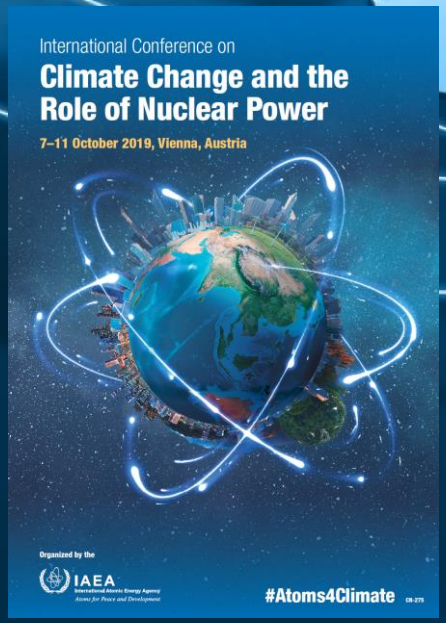
Coordinated Research Projects

Technical Meetings

Training and Workshops

Technical Working Groups

Conferences



GC events

Reactor Technology Innovation to Support Integration of Renewable Energy Systems and Nuclear Installations

Wednesday, 18 September 2019, 14:00–16:00
M7, M building, ground floor

TWG-SMR: 20

TWG-LWR: 22

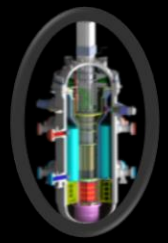
TWG-HWR: 7

TWG-FR: 27

TWG-GCR: 17

TWG-ND : 14

1.1.5.2 (1000153)
Technology Development for small & medium-sized or modular reactors and gas-cooled reactors



HTGRs – Coordinated Research Projects

Completed 2014 CRP on Improving the Understanding of Irradiation-Creep Behaviour in Nuclear Graphite: 2x TECDOCS under preparation

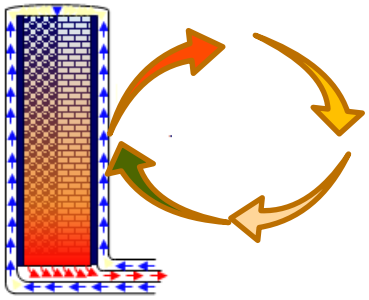
- Part 1: Models and Mechanisms
- Part 2: Recent Developments

To determine the uncertainty in HTGR calculations at all stages of coupled reactor physics, thermal-hydraulics and depletion calculations - Completed 2019

CRP on HTGR Uncertainty in Analysis

Development of Approaches, Methodologies and Criteria for Determining the Technical Basis for Emergency Planning Zone for Small Modular Reactor Deployment (2018-2021)

HTGRs applications for energy neutral sustainable comprehensive extraction and mineral products development –completed 2019



Use process heat
Extract U/Th with products i.e. cleaner fertilizer
U / Th content and extraction studies

NEW CRP proposed:
Technologies to enhance the competitiveness and early deployment of SMRs and HTRs (2020- 2024)

CRP I1026 on Modular High Temperature Gas cooled Reactor Safety Design – 2014 - 2018

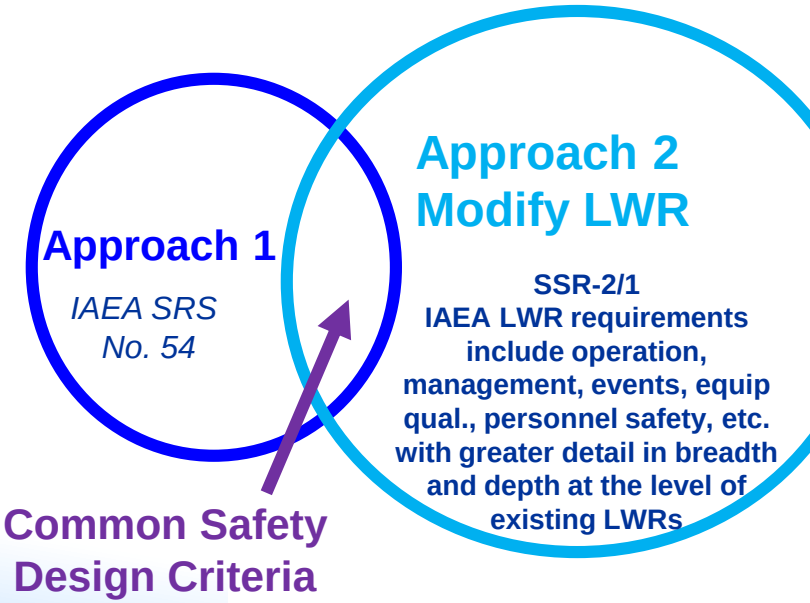
- Investigate modular HTGR safety design criteria to assure that an acceptably broad spectrum of design and beyond design basis events are addressed in the international design and development community
- **Approach 1 limits scope to qualitative, functional statements of how top requirements are to be met for only SSCs that are safety-related for public safety with examples from conceptual design of MHTGR (steam cycle for electricity) / Risk informed approach**
- **Approach 2 study the IAEA SSR-2/1 SDC for applicability / interpretation for modular HTGRs**

10 participating organizations from 9 member states: China, Germany , Indonesia, Kazakhstan, Korea (Republic of), Japan , UK, Ukraine, USA

- 4th RCM 11 – 14 June 2018
- CM 17-20 June 2019

Planned outcomes:

- NE series report: Modular High Temperature Gas-cooled Reactor Safety Design Criteria
- TECDOC: Modular High Temperature Gas-cooled Reactor Safety Design Methodology and Implementation Examples



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Planned
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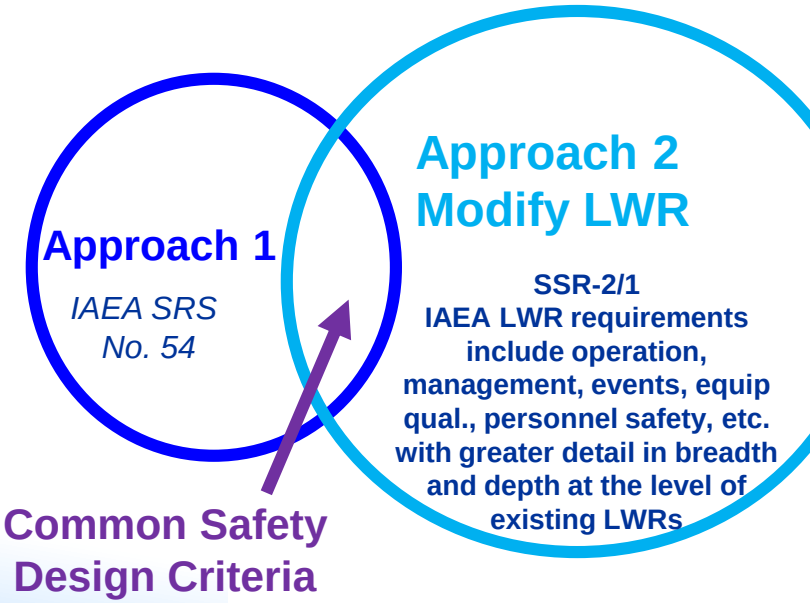
  mplementation Examples

JAPAN played an leading role !



Technical Meetings (TMs) - 2019

- TM on the IAEA Nuclear Graphite Knowledge Base, 7-8 Nov
- TM of the Technical Working Group on **Gas Cooled Reactors**, 11-13 Nov
- TM on Technologies to Enhance the Competitiveness and Early Deployment of **SMRs and HTGRs**, 14-15 Nov
- Joint IAEA–GIF TM on the Safety of **High Temperature Gas Cooled Reactors**, 9-12 December

ICTP-IAEA Workshop Course
Joint ICTP-IAEA Workshop on Physics and Technology of Innovative High Temperature Nuclear Energy Systems (SMR 3281)
14 – 18 October 2019, Trieste, Italy

The Abdus Salam International Centre for Theoretical Physics

Research | Scientific Calendar | Programmes

Europe/Rome | Administration

Search

Search in Conferences:

Overview

Programme

Speakers

Apply here

Practical info

Joint ICTP-IAEA Workshop on Physics and Technology of Innovative High Temperature Nuclear Energy Systems | (smr 3281)

Starts 14 Oct 2019
Ends 18 Oct 2019
Central European Time

ICTP
Kastler Lecture Hall (AGH)
Strada Costiera, 11
I - 34151 Trieste (Italy)

Organizers

Ibrahim Khamis (IAEA), Frederik Reitsma (IAEA), Local Organiser: Nicola Seriani

http://indico.ictp.it/event/8725/

HTGR: Outputs

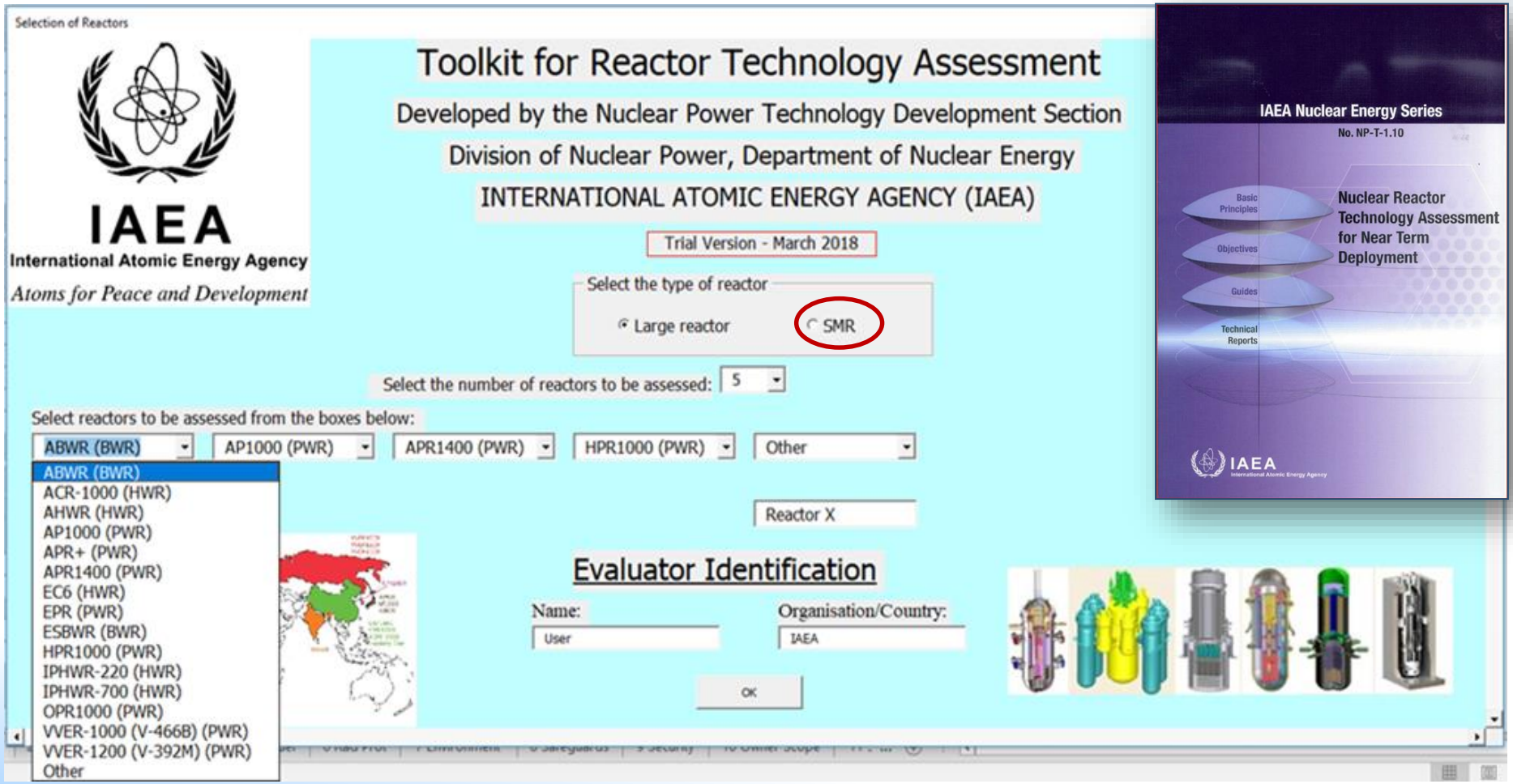
Publications

- TECDOC on Improving the Understanding of Irradiation-Creep Behaviour in Nuclear Graphite: Part 1: Models and Mechanisms
- TECDOC on Role of Nuclear-Grade Graphite in Controlling Oxidation in Modular High Temperature Gas-Cooled Reactors
- TECDOC for each of the CRPs completed
- Development of E-Learning material for HTGRs, based on previous training courses, including materials on SMRs

Other Outputs

- Further enhancement of Knowledge Platform on SharePoint, Taxonomy developed for the Portal as well as IAEA Nuclear Graphite Knowledge Base
- Prepare to receive the transfer of the Knowledge base and software related to the closed HTGRs program of the Research Centre Juelich to the IAEA
- Define and support the preparation of the PC-based basic training simulator for modular HTGRs (to be donated by INET, Tsinghua University)

A new Toolkit to help embarking countries in applying the IAEA methodology on Reactor Technology Assessment → *also for SMR*



Status and Embarking Countries interested in HTGRs




Countries	Recent Milestone
Saudi Arabia	• **Vision 2030 → National Transformation Program 2020: Saudi National Atomic Energy Project:** • An MOU between K.A.CARE and CNNC on **HTGR** development/deployment in KSA
Indonesia	• Through an open-bidding, an experimental 10 MW(th) **HTR-type SMR** was selected in March 2015 for a basic design work aiming for a deployment in mid 2020s • Site: R&D Complex in Serpong where a 30 MW(th) research reactor in operation • BAPETEN, the regulatory body has issued a site license
Jordan	• Several SMR designs considered and feasibility studies are being conducted (two HTGRs designs under consideration)
Poland	• **HTGR** for process heat application to be explored in parallel to large LWRs for process heat only (dependent on industry interest) • **10 MW(th) experimental HTGR at NCBJ** proposed possibly with EU cooperation

Newcomer countries want to employ Nth of a kind…
Demonstration SMR / HTGR plants are needed !

IAEA SMR Booklet 2018 Edition

- Main Features
  - Design description and main features of 56 SMR designs
  - SMRs are categorized in six (06) types based on coolant type/neutron spectrum:
    - Land Based WCRs
    - Marine Based WCRs
    - HTGRs (10 designs from 5 MS)
    - Fast Reactors
    - MSRs
    - Others

- MANY designs not included / not submitted
- Detailed information in the ARIS database

- Next edition… August 2020

Status of SMR pre-licensing in Canada

Vendor	Name / cooling type	(MWe)	Applied for	Review start date	Status
Terrestrial Energy Inc.	IMSR Integral Molten Salt Reactor	200	Phase 1	April 2016	Phase 1 complete
			Phase 2	December 2018	Phase 2 assessment in progress
NuScale Power, LLC	NuScale Integral Pressurized Water Reactor	50	Phase 2*	April 1, 2019	Service agreement signed. Assessment pending
Ultra Safe Nuclear Corporation / Global First Power	MMR-5 and MMR-10 **High Temperature Gas**	5-10	Phase 1	December 2016	Phase 1 complete
			Phase 2	Pending	PHASE 2 Service Agreement in place – Project start pending
Westinghouse Electric Company, LLC	eVinci Micro Reactor Solid core and heat pipes	up to 25 MWe	Phase 2*	Pending early 2019	Service agreement under development
LeadCold Nuclear Inc.	SEALER Molten Lead	3	Phase 1	January 2017	Phase 1 on hold at vendor's request
Advanced Reactor Concepts Ltd.	ARC-100 Liquid Sodium	100	Phase 1	Fall 2017	Assessment in progress
URENCO	U-Battery High-Temperature Gas	4	Phase 1	To be determined	Service agreement under development
Moltex Energy	Moltex Energy Stable Salt Reactor Molten Salt	300	Series Phase 1 and 2	December 2017	Phase 1 assessment in progress
SMR, LLC. (A Holtec International Company)	SMR-160 Pressurized Light Water	160	Phase 1	July 2018	Assessment in progress
StarCore Nuclear	StarCore Module High-Temperature Gas	10	Series Phase 1 and 2	To be determined	Service agreement under development

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Thank you!

For inquiries on SMR, please contact:

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IAEA Nuclear Power Technology Development Section

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