IAEA Activities on Innovative Nuclear Energy Systems R&D

Stefano MONTI
Head of Nuclear Power Technology Development Section (NPTDS)
Exchange of Information:
TWGs, Conferences, International Experts Meetings, TMs

And Various other Technical Meetings…

Technical Working Groups

TWG-LWR: 22
TWG-HWR: 7
TWG-FR: 27
TWG-GCR: 17
TWG-ND : 14
Coordinated Research Activities: Objectives

• Providing opportunities to scientists in developing and developed countries to work together to solve a problem of common interest

Developed Countries
€1 854 010
37%

Developing Countries
€3 094 465
63%
CRP Results/Outputs

- Networks established
- Reports and Databases
- Scientific and Technical Publications
- Proven techniques tested and ready to be transferred
- CRPs leading to TC Projects

CRP Structure

- Contracts
- Agreements
- Research
- Doctoral
- Technical
- RCM1*
- RCM2
- RCM3

Coordinated Research Project

- Distribution to Several Labs: Testing and Validation of the Research
- Results of the Research published. Networking and Proven technologies ready to be transferred

Technical Cooperation

- Technical Cooperation Project to assist in the transfer of technology

Dissemination of the Technology to Member States and Socio-economic Impact

http://cra.iaea.org/
CRPs on Innovative NES

In the Area of Fast Reactors

CRPs on Fast Reactors Technology

- **CRP recently completed**
  - BN-600 MOX Core Benchmark
  - Analytical and Experimental Benchmark Analysis of ADS
  - PHENIX – EOL Tests
  - MONJU – Na Natural Convection

- **CRP currently on-going**
  - EBR-II Shut-down Heat Removal Test
  - NAPRO – Na Properties and Safe Operations of Exp Facilities
  - PFBR – Radioactive release under severe accident condition

- **CRP planned**
  - MONTU – Turbine Trip Test
  - CEFR – Benchmark Analysis on reactor physics start-up tests
  - FFTF – Unprotected Loss of Flow Test

IAEA
CRPs on Innovative NES

In the Area of HTGRs

Completed

Improving the Understanding of Irradiation-Creep Behaviour in Nuclear Graphite

Ongoing

HTGR Uncertainty in Analysis

Modular High Temperature Gas-cooled Reactor Safety Design

HTGRs applications for energy neutral sustainable comprehensive extraction and mineral products development
CRPs on Innovative NES

Other Innovative Areas

Prediction of Axial and Radial Creep in Pressure Tubes

International Collaborative Standard Problems

CFD Codes for Design

Thermal Hydraulics, Materials and Chemistry for SCWR
No Image for Thermal Hydraulics of SCWR

BATRA, Chirayu, 2016-04-12
Identified R&D needs for SMRs

- Human factor engineering, control room staffing and operational procedures for multi-module SMRs plant
- Core flow stability for natural circulation iPWR based SMRs
- Reliability, Uncertainty and Sensitivity Analyses for integrated Control Rod Drive Mechanism in iPWRs
- Hybrid engineered safety system development for iPWR type SMRs
- PSA for a multi-module SMR Plants considering Common Cause Failures
Publications on Recently Completed CRPs on Innovative NES and Related Technologies

- PHENIX – Natural Circulation Test
- PHENIX – Control Rod Withdrawal Test
- BN-600 MOX Core Benchmark Analysis
- MONJU – Na Convection in Upper Plenum
- SCWR – Heat Transfer Behaviour
- IAEA HEEP – Benchmark Analysis
Other Publications on Innovative NES

- Booklets
- Nuclear Energy Series
- Technology Status Documents
Data Bases & Handbooks:
ARIS, THERPRO, Exp. facilities, Na properties
Tool-Kits on Non-electric applications, water management and SAMG-D

- DE-TOP
- HEEP
- WAMP

Programs

Toolkits
Knowledge Organization Systems

IAEA | HTGR-KB

High Temperature Gas-Cooled Reactors KB
Knowledge Base | Events | Wiki | Shared Documents | Modelling CRP | Safety CRP

Pikens

Libraries

Training Course Materials

Knowledge Base

Knowledge Base Addon

Extranets

Wiki

About HTGRs

Modelling CRP

Safety CRP

International Knowledge Base

China

France

Germany

India

Indonesia

Italy

Japan

South Korea

Russian Federation

Safety

Knowledge Organization Systems

The HTGR (High Temperature Gas-Cooled Reactor) is a sustainable and fundamentally safe nuclear reactor technology. These reactors have recently gained global interest, due to their promising features of enhanced safety and improved economics.

There are two main types of HTGRs: the sodium cold reactor (HGR) and prismatic block reactors (PBR). The prismatic block reactor refers to a prismatic core configuration, which is generally preferred due to its potential for higher power density. The sodium cold reactor, on the other hand, is characterized by the use of sodium as a coolant and moderator.

Safety enhancement includes the following characteristics to avoid release of radioactive materials:

- Extreme high temperature capability of the ceramic coated and carbon based fuel and core structures.
- Reactor materials including the reactor fuel are chemically compatible and, in combination, will not react or burn to produce heat or explosive gases. D三冰 is inert and the fuel and materials of construction of the reactor core and the nuclear fuel supply system provide safe reactors.
- Plant design features limit transients of an accident so that the reactor remains shutdown and containment of radioactive material is maintained.
- Single phase and low heat capacity minimize stored energy in the helium coolant.
- Inherent nuclear and heat transfer properties of the reactor design are continually functional to ensure that the fuel temperature remains within acceptable limits under all conditions.

Achieved performance of the reactor core that operates nuclear power as co-resident power, coolant flow in any other active systems or operator actions are required to limit reactor power levels and fuel temperatures under any condition.

There are currently serious research projects around the world and the IAEA is following these programs, conducting research and facilitating information exchange among Member States.

More about HTGRs
HTGR, 19-23 Oct 2015, Indonesia
Thanks for Your Attention!

...Atoms for Peace & Development

https://www.iaea.org/NuclearPower/Technology/home.html