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Status of the IAEA CRP on Fuel Materials for Fast Reactors (FMFR)

M. Veshchunov

Technical Lead (Fuel Engineering)

Nuclear Fuel Cycle and Materials Section

Division of Nuclear Fuel Cycle and Waste Technology

Department of Nuclear Energy

IAEA, Vienna, Austria

m.veshchunov@iaea.org

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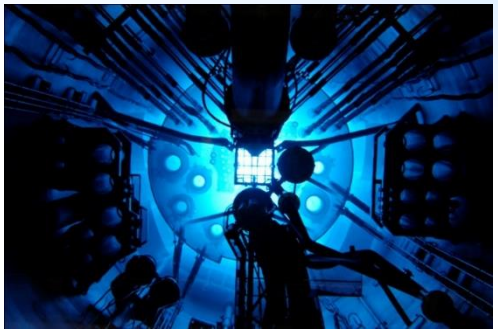
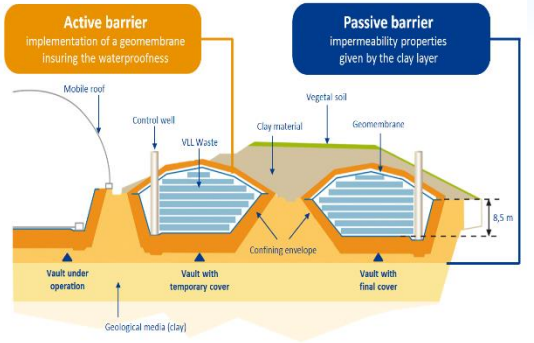
Research Reactors



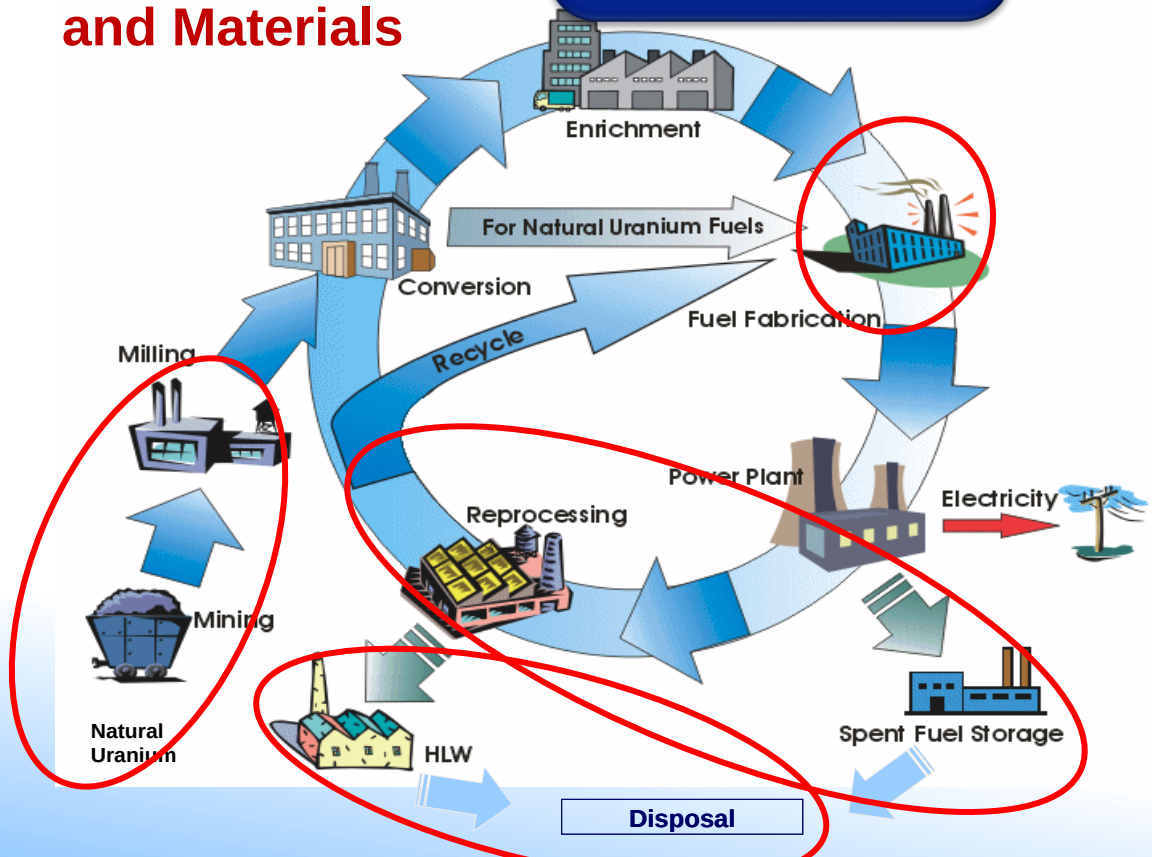
Division of Nuclear Fuel Cycle and Waste Technology

NEFW

Waste Management



Nuclear Fuel Cycle and Materials



Decommissioning Environmental Remediation

Fuel Engineering Programme

- Major Programme (MP) 1: NUCLEAR POWER AND FUEL CYCLE
  - Programme (P) 1.2: Nuclear Fuel Cycle and Materials Technologies
    - Subprogramme (SP) 1.2.2: Nuclear Power Reactor Fuel
      - ✓ Project 1.2.2.1: Nuclear Power Reactor Fuel Engineering

Support Member States (MSs) to understand and address factors affecting the design, fabrication and in-pile behaviour of currently operating and innovative nuclear fuels and materials for power reactors

CRP T12031

➢ Background

- Recommendations of the IAEA TWG FPT, considering the importance of information exchange in R&D on FR materials
- Discussions during previous meetings:
  - IAEA International Conference FR-17 on Fast Reactors and Related Fuel Cycles (Yekaterinburg, June 26-29, 2017)
  - Discussion and information exchange with the OECD/NEA Expert Group on Innovative Fuels, (Paris, 5-6 February 2018)
  - Consultancy Meeting to develop a CRP Proposal on Fuel Materials for Fast Reactors (Vienna, 18-20 June 2018)

Objectives

- Overall Objective
  - Effective dissemination of knowledge and expertise on the behaviour assessment of sodium fast reactor fuel under irradiation conditions
- Specific Research Objectives
  - To strengthen international collaboration by bringing together experts to save national R&D efforts:
    - To promote the sharing of fuel pins' irradiation data from fast neutron experiments and associated post-irradiation examinations
    - To optimize the use of available data from limited number of irradiation facilities
  - To perform simulations of acquired datasets, using various fuel performance codes
    - To compare, analyse and share simulation results among participants, including recommendations on fuel performance codes enhancement and identification of gaps in irradiation data

Key Topics

- To expand the NEA-IAEA IFPE database, currently dedicated to thermal reactors, to include fast reactors (FRs)
- To achieve this, new datasets on prototypic commercial irradiations as well as experiments performed in research reactors will be collected from participants, including:
  - oxide (UO_2/MOX) and metallic (U/U-Pu based alloys) fuels and steel-based claddings
- Simultaneously, some experiments from these datasets will be chosen for international benchmarking exercises for FR fuel performance codes used by MSs

Expected Outcome and Results

- Overall Expected Outcome
  - A knowledge retention tool for supporting fuel designs for fast reactors
  - Enhancing confidence in the use of fuel performance codes that support FRs application
- Nuclear Component
  - Fundamental understanding of radiation effects on core materials and on the properties of fuel materials in high-radiation environments, and advanced modelling/simulation of fuel performance are needed to improve reliability, safety and plant operation of sodium cooled FRs
- Expected Results
  - A common database on prototypic commercial irradiations as well as experiments performed in research test reactors
  - Results of computer modelling of a selected number of cases with the use of different fuel performance codes
  - Scientific publications, presentations at international conferences and final CRP report (TECDOC)

Duration, Budget and MSs' participation

- Planned duration: 2019 – 2022
- Budget
  - PTAEO: Project_1000033 (1.2.2.001 Nuclear power reactor fuel engineering and operation) / 2018.08 New CRP / RBF-MP1-2018 / xxx / NEFW-NFCMS
- MSs' participation

Participant	Country
CEA	France
EC- JRC	Germany
CRIEPI	Japan
JAEA	Japan
IGCAR	India
KAERI	Korea, Republic of
INM	Russian Federation
IBRAE	Russian Federation
ANL	United States
INL	United States

Observer	
OECD-NEA	France

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1st RCM: October 2-4, 2019 (Vienna)

➢ Objectives

- Discuss plans of the proposed research of the individual participants, its relationship to the overall objectives of the CRP and to promote interaction between the participants through discussion
- Identify the projects of common interest in order to establish close collaboration between different teams and design joint activities
- Determine the first phase of work plans and timelines for each participant as part of the CRP

Irradiation Test Data and Fuel Performance Codes

		Irradiation data	Code
RUSSIA	INM	MOX / UO_2 (BN-600)	-
	IBRAE	-	BERKUT (Oxide, MOX)
India	IGCAR	MOX (FBTR)	(MOX) (Metal)
Japan	JAEA	MOX B5D2 (JOYO)	CEPTAR (MOX)
	CRIEPI	Metal METAPHIX 1 (Phenix)	ALFUS (Metal)
KOREA	KAERI	HT9 cladding (BOR-60)	MACSIS (Metal)
FRANCE	CEA	MOX (BOITIX or SANTENAY) (Phenix)	GERMINAL (MOX)
USA	ANL	Metal (EBR-2)	LIFE-METAL (Metal) BISON (Metal)
	INL	MOX (FFTF - FO2)	BISON (Metal) BISON (MOX)
EC	JRC	METAPHIX 2 (Metal), or KNK-II or SUPERFACT (MOX)	TRANSURANUS (MOX)

Benchmark Exercises

	Russia	India	Japan		Korea	France	USA		EC
	IBRAE	IGCAR	JAEA	CRIEPI	KAERI	CEA	ANL	INL	JRC
	BERKUT (Oxide, MOX)	MOX Metal (India)	**CEPTAR** (MOX)	**ALFUS** (Metal)	**MACSIS** (Metal)	**GERMINAL** (MOX)	**LIFE** (Metal) **BISON** (MOX)	**BISON** (Metal, MOX)	**TRANSURANUS** (MOX)
MOX /UO_2 (BN-600)	+	+/-	+/-	-	-	+/-	-	+	?
MOX (FBTR)	+	+	+	-	-	+	-	+	?
MOX B5D2 (JOYO)	+	+	+	-	-	+	-	+	?
Metal METAPHIX 1 (Phenix)	-	-	-	+	+	-	+	+	?
HT9 clad (BOR-60)	-	+	-	-	+	-	+	+	?
MOX (BOITIX or SANTENAY) (Phenix)	+	+	+	-	-	+	-	+	?
Metal (EBR-2)	-	+	-	+	+	-	+	+	?
MOX (FFTF - FO2)	+	+	+	-	-	+	-	+	?
METAPHIX 2 (Metal)	-	-	-	+	+	-	+	+	?
KNK-II or SUPERFACT (MOX)	+	+	+	-	-	+	-	+	?

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THANK YOU,

and welcome
to the new CRP!
(still open for participation)