

Strengthening ICN International Cooperation

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- RATEN ICN - in brief
- Objectives and outcomes of the international cooperation program
- Cooperation framework
- Examples of on-going collaboration activities
- Aims for our future international collaboration program
- Conclusions

RATEN

Romanian legal Entity established in 2013, October 1st, under Authority of the Department for Energy of the Ministry of Economy, as a State Owned Company

Subsidiaries:

RATEN ICN - Institute for Nuclear Research Pitesti, (www.nuclear.ro)

RATEN CITON - Centre of Technology and Engineering for Nuclear Projects, Bucharest-Magurele, (www.citon.ro)

Mission:

- *provide scientific and technological support for the national nuclear power program;*
- *Education and training, continuous developement of the scientific and technical competence including safety related expertise during the life-time of the nuclear installations;*
- *International cooperation activities in the nuclear energy field*

International Cooperation objectives

Reasons for International collaboration:

- **Large and complex projects need to pool the human and material resources for a more efficient use;**
- **To complement the knowledge in different fields;**
- **Harmonize the safety approaches;**

Create and maintain a high level of competence to support the national nuclear program

- **joint R&D projects**
- **training and consultation**
- **exchange of information;**
- **transfer of knowledge**

Develop complex R&D projects

- **Gen IV (LFR)**
- **Waste Disposal**
- **Mo99 production**

Contribute to the international efforts promoted by IAEA, EC, COG..

Expected outcomes of the international cooperation program

Consolidation of the international partnerships signed by ICN, in parallel with continuous enlargement of bilateral collaboration with other nuclear research centres – in support to the R&D priorities

Strengthening RATEN participation in international organisations in the nuclear field (IAEA, COG, NEA-OECD, GIF-EURATOM, etc)

Increase of ICN contribution in the international research programs (Euratom-fission H2020, JRC, IAEA's CRP).

Facilitate participation of ICN specialists in training programs and human resources formation

Ensure ICN involvement in European and international structures in order to promote the Romanian R&D in nuclear

- *Bilateral collaboration* based on agreements and memorandums signed with nuclear research centres
- *Collaboration within international organisations*
IAEA, COG, NEA-OECD, GIF-EURATOM, WNU
- *Collaboration with the EC and its structures*
- *International Consortia and Partnerships*

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Our bilateral agreements

- **Collaboration with GRS – Germany** – ‘90s - under NATO contracts – Geological disposal
- **Collaboration with CANDU – CANADA** - Memorandum of Understanding between Department of Natural Resources of Canada and Romanian Ministry of Economy, signed in 1999, renewed in 27 Mai 2009
- **Collaboration with IRSN – France** – Agreements for the use of different computer code (ASTEC, ICARE/CATHARE, etc) – 2003
- **Collaboration with JRC – ITU** – License agreement on TRANSURANUS code (2005)
- **Collaboration with DoE – USA** - Agreement for information exchange and collaboration in the peaceful use of atomic energy (1999)
- **Collaboration with CEA- France** - Agreement in the field of nuclear energy research and technology (April 2008)
- **Collaboration with SCK.CEN – Belgium** - Memorandum of Understanding (July 2009)

Scope of collaboration

- **CANDU nuclear fuel;**
- **Nuclear safety;**
- **Nuclear Power Plant life management**

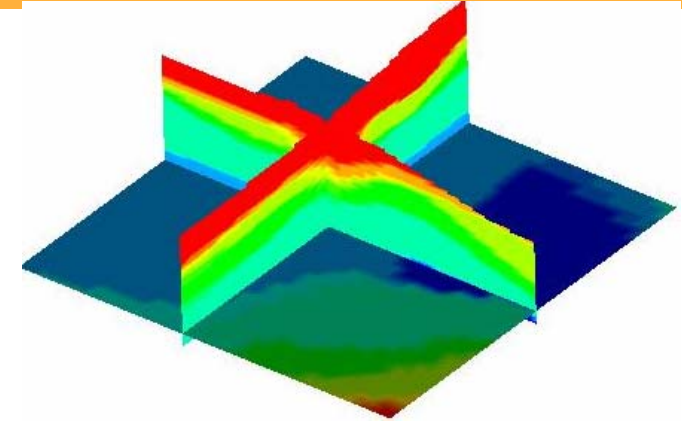
Projects with CANDU Energy (former AECL)

- **Power cycling condition for CANDU fuel in C9 capsule of TRIGA reactor;**
- **Fatigue test for Zircaloy - 4 sheaths;**
- **Transfer, implementation and validation of computer codes for nuclear safety analysis and design.**

Initiated in 1999 under Sister Laboratory program

Scope of collaboration:

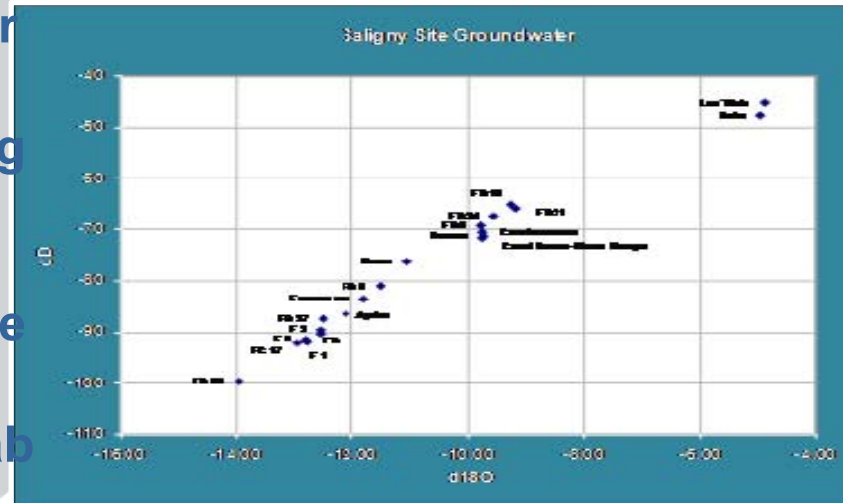
- neutron computation (ORNL)
- waste management (LANL)
- radioisotopes production for medical use (ORNL)
- non-destructive analysis (LANL)
- transfer of spent fuel (ANL)



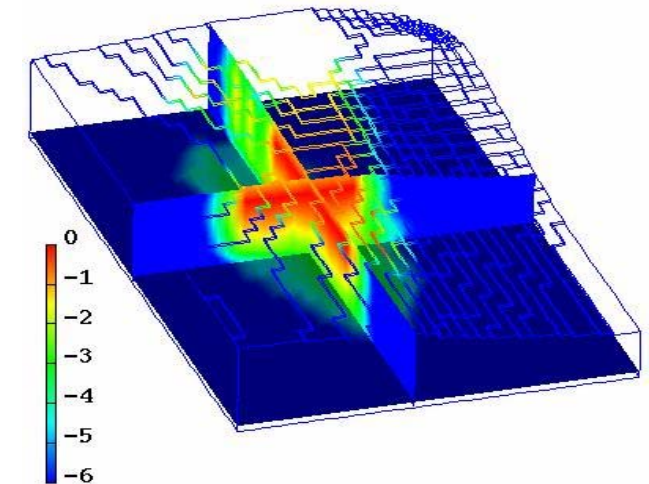
Saligny Site stratigraphy

Main results

- complex site grid for the Saligny site
- better understanding of Saligny site
- accurate models, continuous decrease of uncertainties
- confidence in ICN lab data



High sensitivity water analysis:
Origins and correlations with surface waters or between them



H-3 plume predicted by FEHM

VERDUN experiment

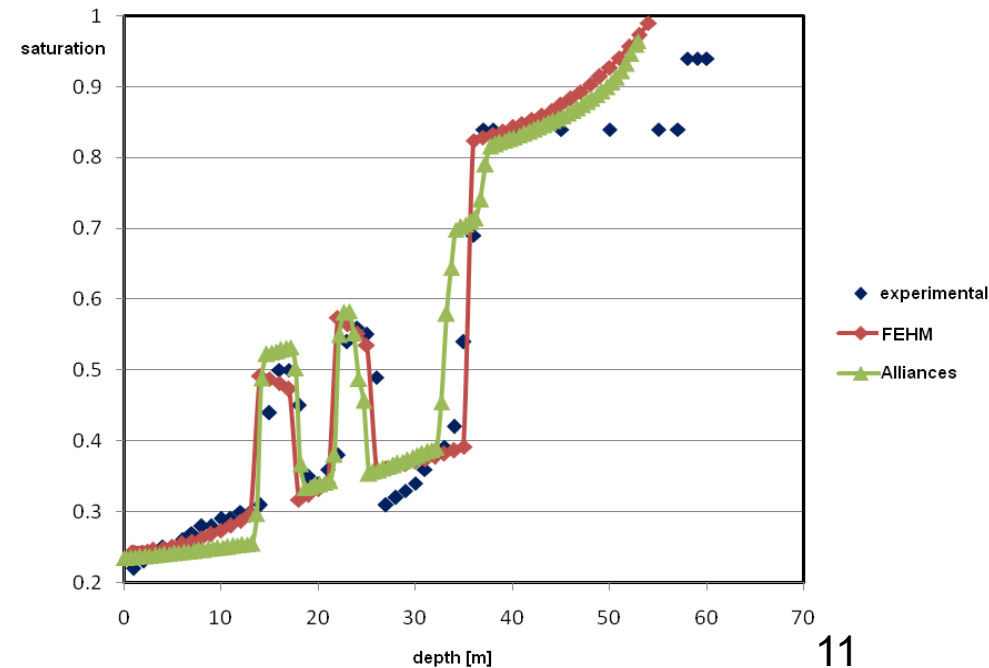
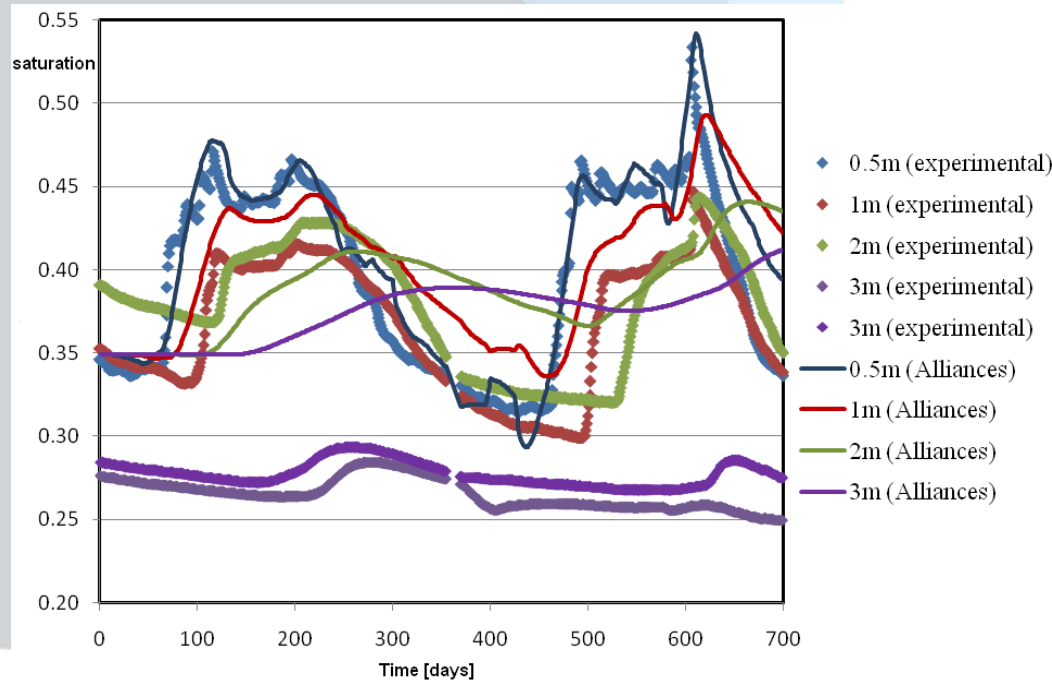
Gamma scanning analysis of fission products release

NSRAWD - Numerical simulation for waste disposal

Transfer and training on Platform Alliances

Application to the Saligny site

Inter-comparison with other computer codes



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Historical collaboration – '50s

Participation in CRP

- *RO 16798 - Factors Affecting the Zirconium Alloys Behaviors due to Hydrogen up-take*
- *RO 17519 - Prediction of Axial and Radial Creep in CANDU6 Pressure Tubes*
- *RO 16705 - Benchmarking of advanced materials pre-selected for innovative nuclear reactors*
- *RO 17216 - The neutron and gamma imaging method combined with neutron-based analytical methods for cultural heritage research*
- *RO 18226 - Development of a Fuel Bundle with 43 Elements Containing Mixed Oxide with Thorium and Uranium (T43) in INR*

Technical Assistance Projects

- *ROM 024 – Conversion of TRIGA reactor from HEU to LEU*
- *ROM0007 - Supporting a Refuelling Simulator and Nuclear Knowledge Management Tool*

Participation in Regional Program

Participation in INPRO (International Program for Innovative reactors and fuel cycles) – projects: INPRO-SYNERGY, INPRO - KIND

Hosting Fellowships (*nuclear safety, nuclear fuel fabrication, research reactors*)

Hosting IAEA workshops, training courses

Practical Arrangement for collaboration on E&T and knowledge management (*in preparation*)

INIS DB – alternate contact

Evaluation of the COG R&D reports for Cernavoda NPP:

Fuel Channels
Safety & Licensing
Health, Safety and Environment
Chemistry, Materials & Components
Industry Standard Toolset

COG R&D contract: Developing Irradiated Testing Facilities at ICN
development of INR capability to test irradiated material in the hot cells.
Types of tests to be develop cover DHC testing and associated with
material (PT) surveillance.

Extension of ICN involvement in COG R&D program – *under consideration*

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Collaboration within the Euratom

												MATISSE	MATISSE	MATISSE
												EAGLE	EAGLE	EAGLE
										NEWLAN CER	NEWLAN CER	ARCADIA	ARCADIA	ARCADIA
										SEARCH	SEARCH	SEARCH	SEARCH	SEARCH
										MATTER	MATTER	MATTER	MATTER	MATTER
										FORGE	FORGE	FORGE	FORGE	FORGE
										CARBO	CARBO	CARBO	CARBO	CARBO
										CAST	CAST	CAST	CAST	CAST
						NULIFE	NULIFE	NULIFE	NULIFE	STYLE	STYLE	STYLE	STYLE	STYLE
						ELSY	ELSY	ELSY	ELSY	LEADER	LEADER	LEADER	ESNII+	ESNII+
				HOTLAB	HOTLAB	MTR+I ³	MTR+I ³	MTR+I ³	MTR+I ³	ADRIANA	ADRIANA		MARISA	MARISA
	JSRI													
		COWAM2	COWAM2	COWAM2	CIP	CIP	CIP			IPPA	IPPA	IPPA	PLATENSO	PLATENSO
	PHEBEN 2	PHEBEN 2	SARNET	SARNET	SARNET	SARNET	SARNET	SARNET2	SARNET2	SARNET2	SARNET2	ASAMPSA_E	ASAMPSA_E	ASAMPSA_E
2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	

FP5


FP6

FP7

Membership in European TPs, networks and structures




Elaboration of SRA; participate in the decision process at EU level on the R&D agendas; promote the national priorities



Find appropriate solutions for improving knowledge transfer to LAP countries and assist them in their progress towards geological disposal



Project CONCERT - 2015



Studies on the material behaviour, nuclear safety, waste management



Member of JPNM – advanced materials for Gen IV – ODS

Planned: member of ENEN, ETSO

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- Signed in December 2013
- Partners: ANSALDO, ENEA, CVR and ICN

Consortium for the cooperation on lead cooled fast reactor demonstrator development

Activities in the preparation of ALFRED demonstrator



- iCRADLE – infrastructure for Cooperative Research to advance up to demonstration the lead technology in Europe
- open pan-European infrastructure

- CANDU technology (nuclear safety, material studies, fuel behaviour)
- New reactors (Gen IV, SMR,)
- Radioisotopes production (Mo99, Yr, ...)
- Waste management (Spent fuel, LL-ILW)
- Radioprotection
- Education and training in nuclear

Goals:

- inter-comparison of research results;
- joint development of new technologies / equipment's;
- create a regional technology center at ICN;
- provide staff training from worldwide;
- joint educational programs in cooperation with universities;

- *Strategic objectives*
 - Consolidation of the international partnerships
 - Strengthening participation in the activity of international organisations in the nuclear field
 - Increase the contribution in the international research programs (Euratom-fission H2020, JRC, IAEA's CRP).
 - Facilitate participation of the specialists in training programs and human resources formation
 - Contribute to the European R&D efforts in nuclear and promote the Romanian R&D priorities
- *Benefits of international cooperation:*
 - Build new competence, maintain a high scientific level (expertise, methods)
 - Shorten time in solving different problems
 - increase visibility of our research potential and broaden participation in larger international collaborative projects