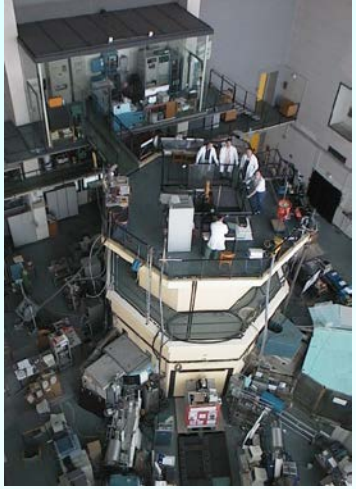

HUMAN RESOURCES DEVELOPMENT BY THE EASTERN EUROPEAN RESEARCH REACTOR INITIATIVE (EERRI)

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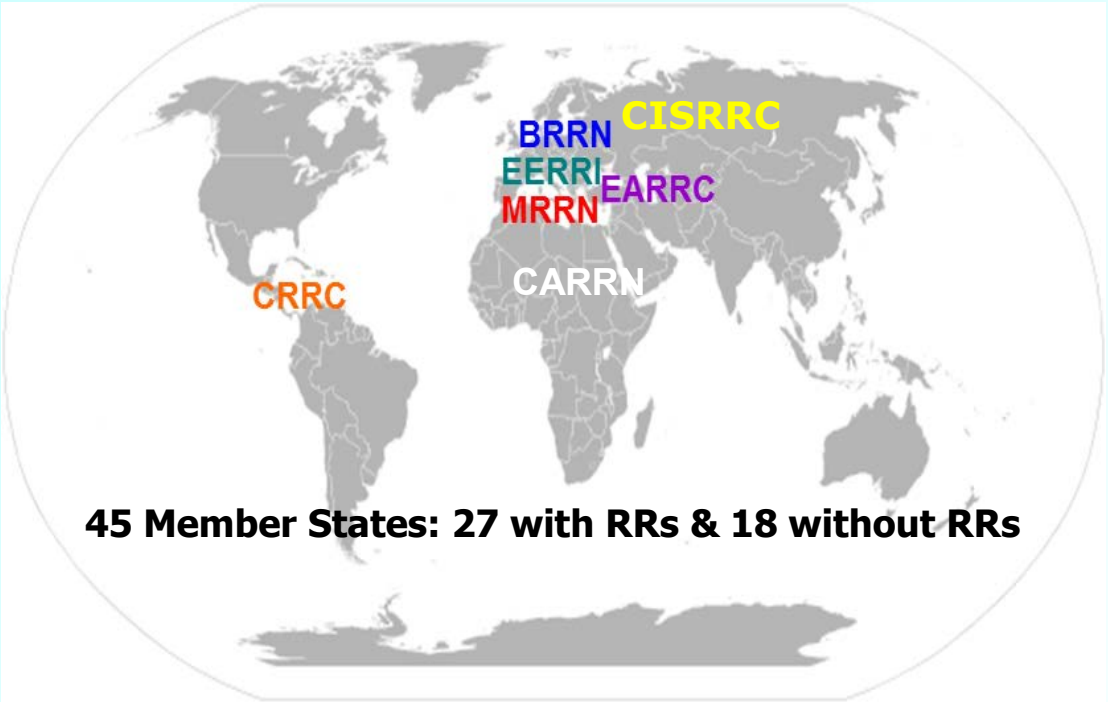
Research Reactor Networks and Coalitions



1.	**EERRI**	**Eastern European RR Initiative,**	**multipurpose,**	**6 MS**
2.	**CRRC**	**Caribbean RR Coalition,**	**mainly NAA,**	**3 MS**
3.	**EARRC**	**Eurasian RR Coalition,**	**isotope production,**	**5 MS**
4.	**BRRN**	**Baltic Research Reactor Network,**	**multipurpose,**	**10 MS**
5.	**MRRN**	**Mediterranean RR Network,**	**multipurpose,**	**12 MS**
6.	**CARRN**	**Central Africa RR Network,**	**multipurpose,**	**9 MS**
7.	**CISRRC**	**CIS RR Coalition,**	**multipurpose,**	**7 MS**
8.	**GTRRN**	**Global TRIGA RR Network,**	**multipurpose,**	**in progress**

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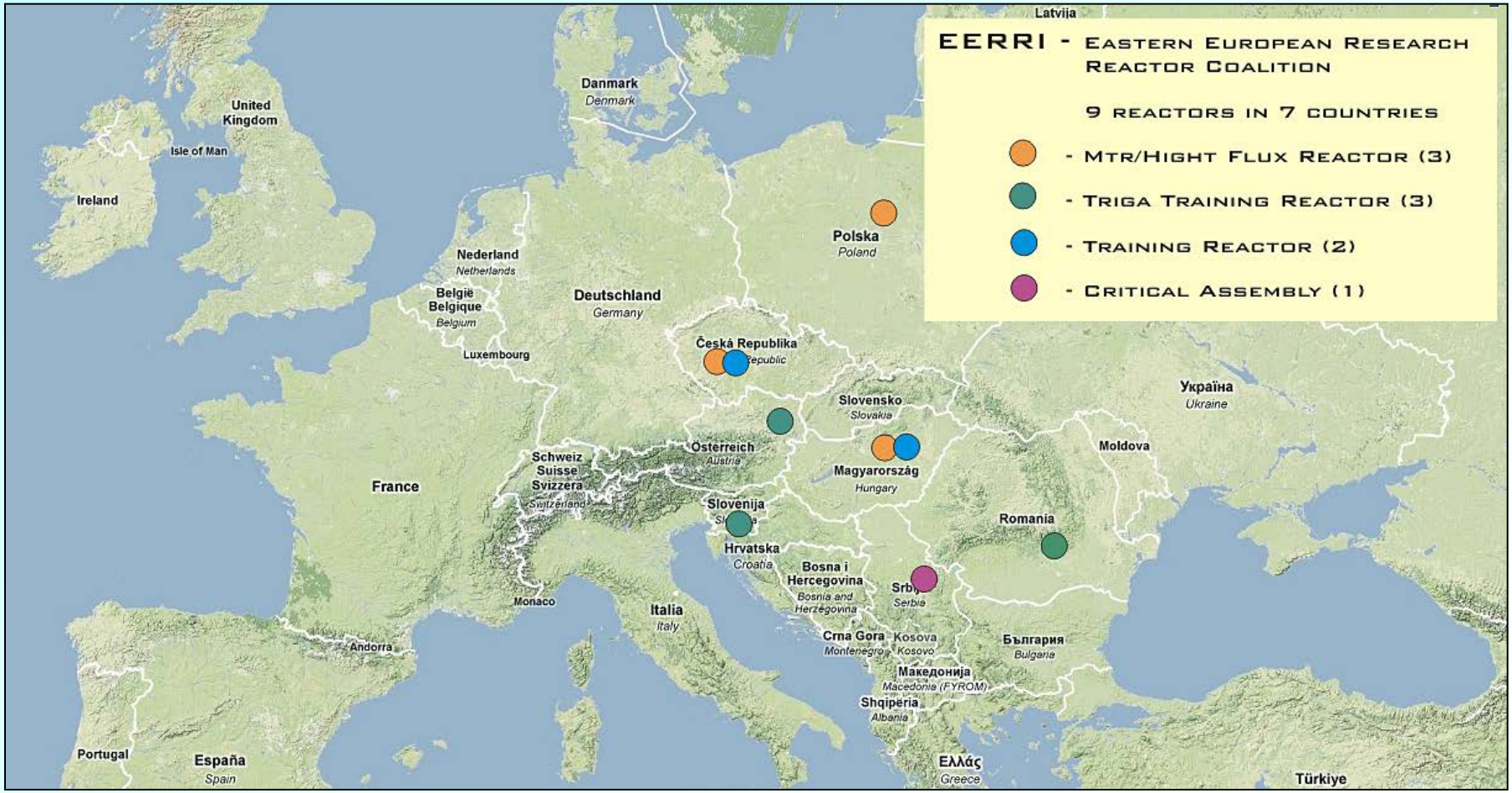
Acronym Region	Name	No. of countries Purpose
Working coalitions:		
EERRI Central Europe	Eastern European Research Reactor Initiative	7 countries multipurpose
BRRN North Europe	Baltic Research Reactor Network	10 countries multipurpose
CRRC Caribbean	Caribbean Research Reactor Coalition	3 countries mainly NAA
EARRC Whole world	Eurasian Research Reactor Coalition	5 countries isotope production
Newly established in last 3-6 months:		
MRRN Mediterranean	Mediterranean Research Reactor Network	10 countries multipurpose
ARRN Africa	African Research Reactor Network	16 countries NAA, education
APRRN Asia & Pacific	Asia-Pacific Research Reactor Users Network	11 countries neutron scattering
Planned:		
NSARRC Americas	North-South America Research Reactor Coalition	

EERRI Research Reactor Coalition



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Example: EERRI Research Reactor Coalition

NRI CVUT IJS

Eastern European Research Reactor Initiative

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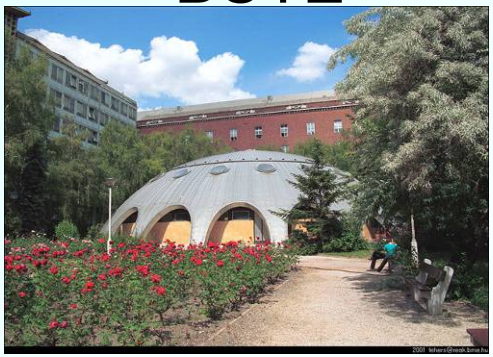
IAE BRR BUTE INS



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EERRI Research reactor coalition

- Eastern European Research Reactor Initiative (EERRI) established in January 2008
- 9 reactors in 7 countries
- Austria, Czech Republic, Hungary, Poland, Romania, Serbia, Slovenia
- 3 MTR/High flux reactors - BRR, Maria, LVR-15
- 3 TRIGA training reactors - ATI, IJS, INR
- 2 Training reactors - VR-1, BUTE
- 1 Critical assembly - Vinca
- power – 1 W to 20 MW
- both steady state & pulse mode of operation

EERRI Coalition Activities

Why?

- Coordination in utilization of the reactors
- Sharing the experimental facilities
- Providing complex services to customers
- Synergy benefit for EERRI members

What?

- Beam applications and neutron scattering
- Radioisotope production
- Fuel and material testing
- **Nuclear Education and Training**

250 kW TRIGA Mark II Reactor Vienna

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100 kW Training Reactor
Techical University of Budapest

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250 kW TRIGA Reactor
Jozef Stefan Institut Ljubljana

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Eastern European Research Reactor Initiative (EERRI)

RR Group Fellowship Training Course (6 weeks)

- EERRI: organized by partners in Austria, Czech Republic, Hungary, & Slovenia
- IAEA: implementation and financial support through TC projects
- Contents: theoretical courses, hands-on training, IAEA lectures, evaluations
- Participants (Status 1.5.2014): 53 fellows from 22 countries trained during 8 courses
- Future: next course starts in September 2014

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EERRI Education and training activities

2. EERRI course (CTU)

EERRI Education and training activities

1. EERRI course (ATI)

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EERRI Education and training activities

Subject	Reactor	CTU	ATI	IJS	BUTE	KFKI	NRI
Regulatory requirements		yes		yes	yes		
Research reactors management		yes	yes	yes	yes	yes	yes
Research reactors review		yes	yes	yes	yes	yes	yes
Research reactors utilization		yes	yes	yes		yes	yes
Introduction to nuclear physics		yes	yes		yes		
Reactor physics		yes	yes	yes	yes		
Thermohydraulics of research reactors		yes			yes		
I&C Systems		yes	yes				
Maintenance and inspection programs		yes	yes			yes	yes
Fuel management, fuel cycle, fuel burnup				yes	yes	yes	yes
Water chemistry						yes	yes
Waste management					yes	yes	yes
Radiation protection		yes	yes		yes	yes	yes
Emergency procedures		yes			yes	yes	yes
Decommissioning of research reactor					yes	yes	yes

EERRI database of educational subjects (part of database, September 2014)

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List of Countries with Trainees

- **Azerbaijan**
- **Brazil**
- **Chile**
- **Colombia**
- **Democratic Republic of Congo**
- **Egypt**
- **Estonia**
- **Iraq**
- **Jamaica**
- **Jordan**
- **Lebanon**
- **Libya**
- **Malaysia**
- **Mexico**
- **Oman**
- **Pakistan**
- **Philippines**
- **Saudi Arabia**
- **Syria**
- **United Arab Emirates**
- **Vietnam**
- **Yemen**

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Day	Morning 9-12h, 20 min Coffee	Afternoon 13-16h Break as required	Location
WEEK 1			
Day 1	Administrative Procedures Visit to the TRIGA facility	Research Reactor Overview	ATI
Day 2	RR utilization	RR vs Nuclear Power Plants	ATI
Day 3	Regulatory requirements	RR Staffing	ATI
Day 4	Strategic planning for RR	Code of Conduct for RR	ATI
Day 5	Introduction to Radiation Protection and instrument demonstration	Test and discussion on week no 1	ATI
WEEKEND	VIENNA		
WEEK 2			
Day 6	Reactor Physics 1	Determination of the thermal neutron flux density in the TRIGA reactor	ATI
Day 7	Reactor Physics 2	Power calibration and temperature coefficient	ATI
Day 8	Critical experiment	Calibration of control rods, etermination of reactivity worth and excess reactivity	ATI
Day 9	RR I&C systems	Demonstration of I&C Detectors	ATI
Day 10	Demonstration of fuel handling and fuel transfer	Test and discussion on week no 2	ATI
WEEKEND	VIENNA		
WEEK 3	Preparation of Safety Analysis Report (SAR)	Safety assessment for RR	ATI or IAEA
Day 11	Training of operating personnel	Special applications of RR (BNCT, Silicon doping, isotope production etc)	ATI or IAEA
Day 12	RR maintenance and in-service inspections	RR Decommissioning	ATI or IAEA
Say 13	NPP-PWR overview	NPP-BWR overview	ATI or IAEA
Day 14	Public Information	Physical security	IAEA
Day 15	Demonstration of prompt criticality	Test and discussion on week no 3	ATI

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WEEK 4			
Day 16	Introduction to reactor calculations	Introduction to computer codes WIMS (demonstration and computer exercises)	IJS at ATI or IAEA
Day 17	RR reactor physics parameters and models	Introduction to computer codes - TRIGLAV (demonstration and computer exercises)	IJS at ATI or IAEA
Day 18	Calculation of RR safety parameters	Introduction to computer codes MCNP (demonstration and computer exercises)	IJS at ATI or IAEA
Day 19	Burn-up calculations and core optimization	Questions and problems from the participants (discussion and computer exercises)	IJS at ATI or IAEA
Day 20	Questions and problems from the participants (discussion and computer exercises)	Questions and problems from the participants (discussion and computer exercises) Test and discussion on week 4	IJS at ATI or IAEA
WEEKEND	TRANSFER FROM VIENNA TO BUDAPEST		
WEEK 5			
Day 21	The BRR (VVR-10 MW) reactor as a tank type RR reactor	Reactor systems - site visit BRR's utilization	KFKI Budapest
Day 22	RR management (operation and utilisation issues)	Emergency procedures	KFKI Budapest
Day 23	Water chemistry in general and in practice at BRR	Personal monitoring Environmental monitoring	KFKI Budapest
Day 24	Quality assurance in practice at a research reactor	Nuclear project planning and implementation	KFKI Budapest
Day 25	Site visit	Site requirements, Public information Test and discussion on week 5	TU Budapest
WEEKEND	BUDAPEST		
WEEK 5			
Day 26	Thermal hydraulics	Thermal hydraulics	TU Budapest
Day 27	Waste management	Radiation protection	TU Budapest
Day 28	Practical course in radiation protection and dosimetry	Practical course in radiation protection and dosimetry Test and discussion on week 6	TU Budapest
Day 29	TRANSFER FROM BUDAPEST TO VIENNA		
Day< 30	FINAL COURSE DISCUSSION		IAEA

EERRI experiences and conclusions

- Collaboration in:
  - education and training is very easy
  - beam experiments are easy
  - fuel and material testing is more difficult
  - isotopes productions is very difficult
- Collaboration between:
  - low power research reactors is very easy
  - medium power research reactors is easy
  - high power research reactors is difficult

EERRI experiences and conclusions

- Such a six weeks course with a wide variety of subjects and practical experiments is extremely difficult to organize by a single research reactor due to limited staff, limited reactor availability and limited time availability
- Using a coalition of reactors such as EERRI is an excellent example to offer in a short time different research reactor types and selected experiments to the participants
- These coalition activities aim to transfer knowledge from one region (country) into another region (country) in a short time period
- During this training period further contacts may be established between the host organisations and participant‘s research institute for further cooperation
- EERRI is one typical example of an international course with hands-on capacity building and international knowledge transfer

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