



ROSATOM

STATE ATOMIC ENERGY CORPORATION "ROSATOM"



# Training Solutions to Support Embarking Countries in the Framework of Practical Arrangements with the IAEA: Lesson Learned in ROSATOM Central Institute for Continuing Education&Training

*Vladimir Artisiuk,  
Vice-Rector of ROSATOM- CICE&T,  
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International Conference on Human Resource Development for  
Nuclear Power Programmes: Building and Sustaining Capacity.  
IAEA Headquarters, Vienna, Austria  
12–16 May 2014

# Contents

1. Introduction in ROSATOM-CICE&T Activities
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# Obninsk- cradle of the NPP development



**Central Institute  
for Continuing Education&Training  
Since 1967  
(SAEC “ROSATOM”)**



**2009- branch of National Research Nuclear University MEPhI  
1985- Obninsk Institute for Nuclear Power Engineering  
1953- branch of Moscow Engineering&Physics Institute  
(Ministry of Education&Science)**



**The-First-in-the-World Nuclear Power Plant  
27 June, 1954**

# Training complex in Obninsk (17980 sq m)

249031 Kurchatov str 21,  
Obninsk, Kaluga region

**Available facilities:** conference halls accommodating from 100 to 500 persons, lecture rooms for 100 and 220 persons, a classroom equipped for simultaneous interpretation and coffee break space, academic council room for 35 persons, 15 classrooms for 40-50 persons, 3 computer classes, two negotiation rooms, occupational and radiation safety room, 2 classrooms for training foreign staff

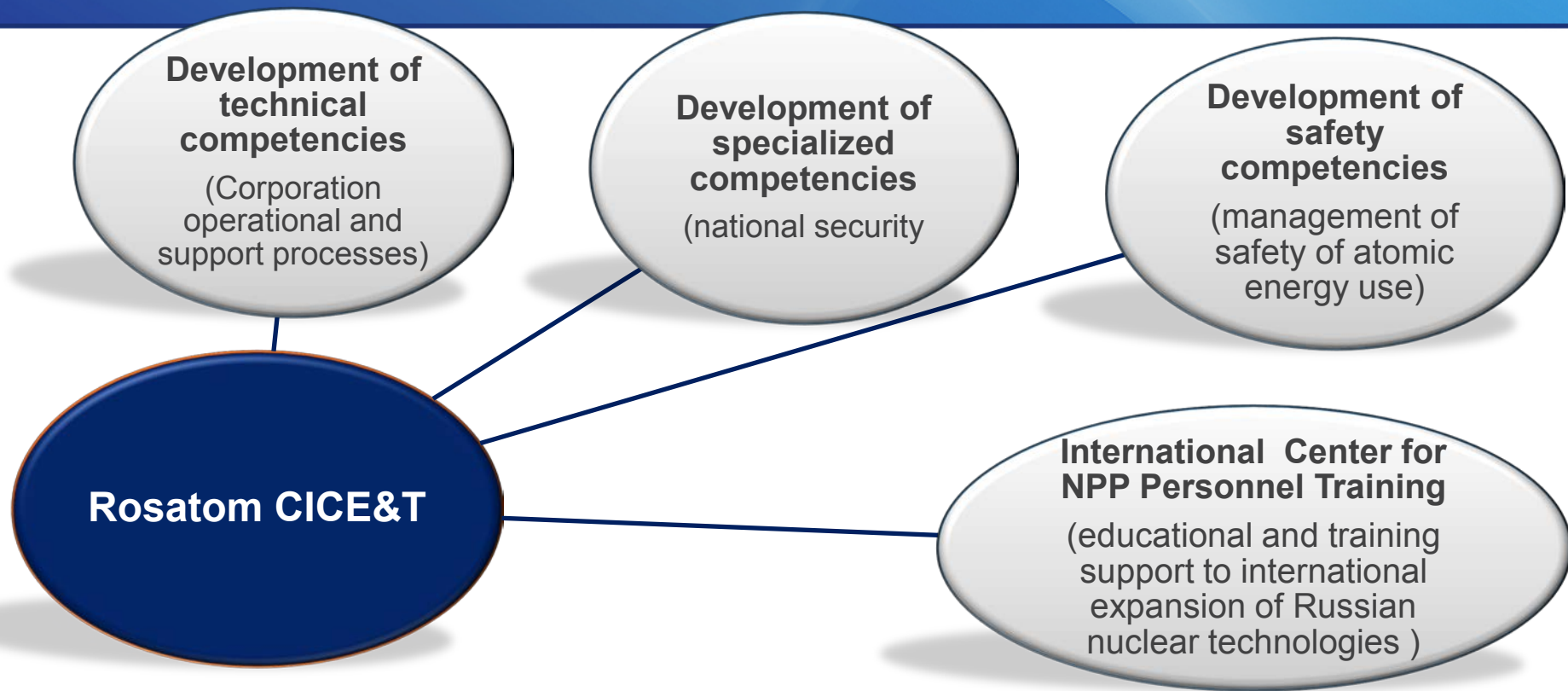
**Hotel:** accommodation of 416 persons ranging from economy to first class rooms. Free of charge internet, guarded parking lot

**Recreational facilities:** gymnasium, sauna, organization of sightseeing

**Catering:** cafeteria for 48 persons, restaurant for 40 persons, canteen for 200 persons and guest room for 25 persons



# Rosatom CICE&T Lines of Activities



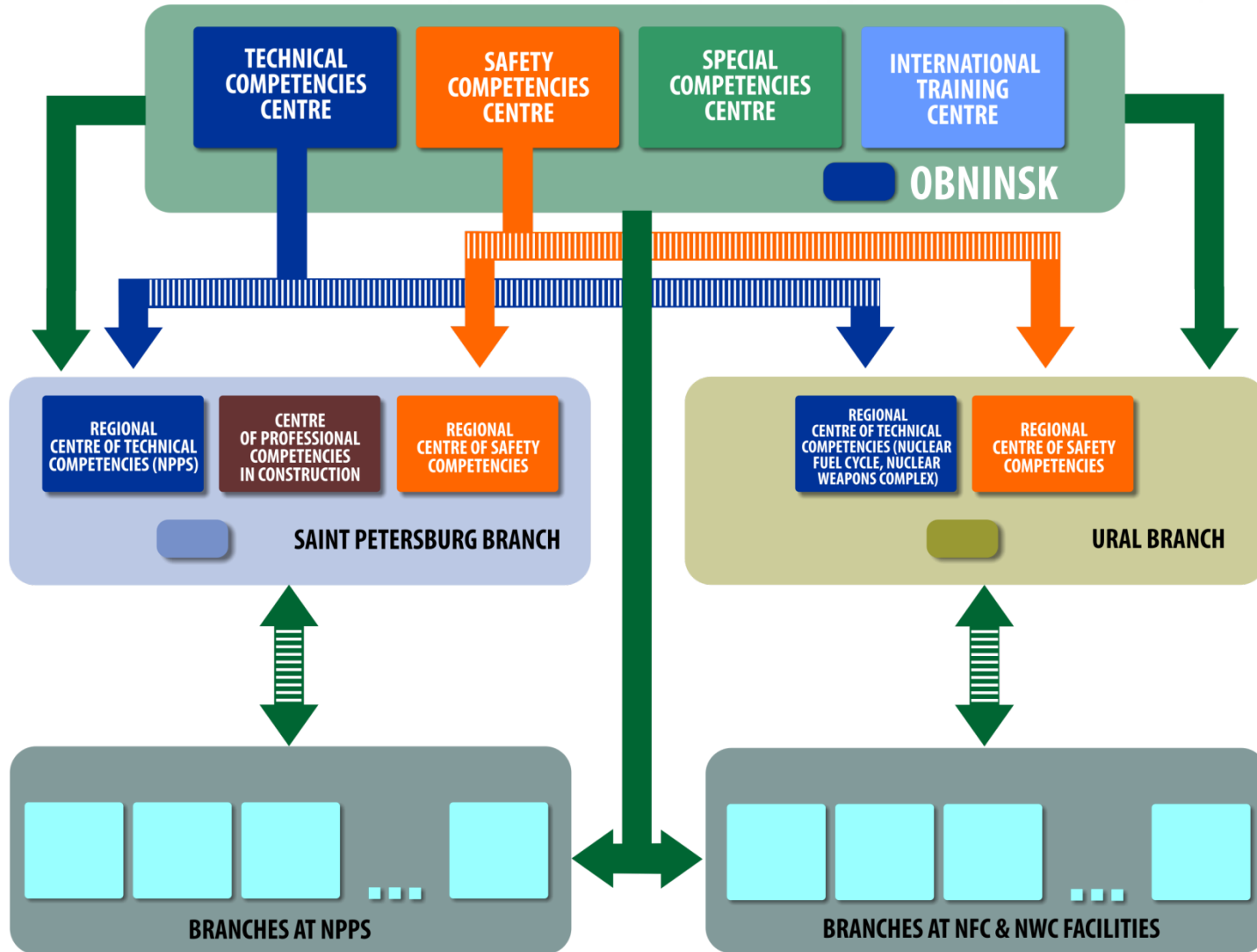
**Consulting:** developing and maintaining technical teaching aids, remote learning systems and training management systems; designing personnel training systems, development of industry standards and organizational maintenance documents, development of training materials, training trainers

# Training Complex in St Petersburg

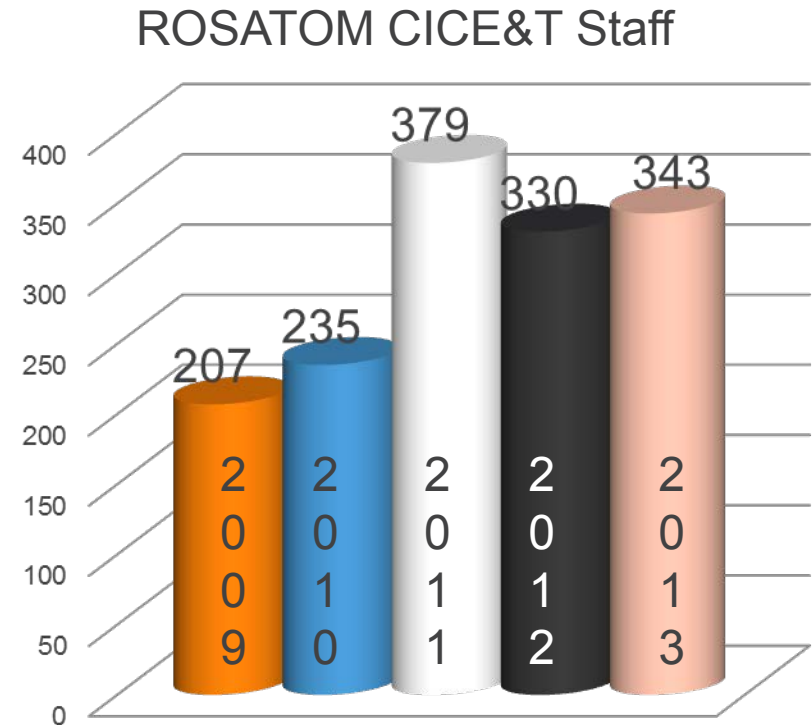
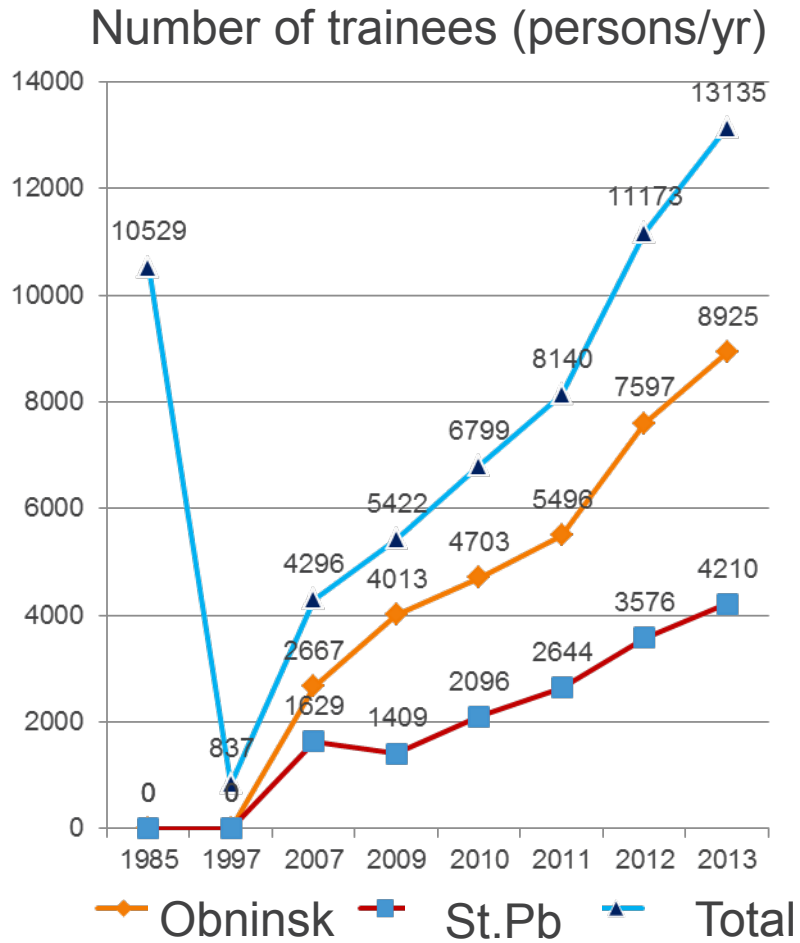
**Available facilities:** 3 conference rooms: one for 350 persons and two for 70 persons each,  
12 classrooms: 1 room accommodating 90 persons, 3 rooms - 15 persons each and 8 rooms –  
for 20-45 persons, 6 computer classrooms having 118 working places connected to local  
network and Internet, communication terminal of Rosatom crisis center, exhibition premises  
covering general nuclear power issues, full-scale simulator for a floating NPP  
**Dormitory** for 250 persons (151 rooms) ranging from economy class to luxury rooms  
**Catering:** 200 places canteen with a guest room for 10 persons  
**Recreational facilities:** gymnasium, organization of sightseeing



# CICE&T Organization Chart

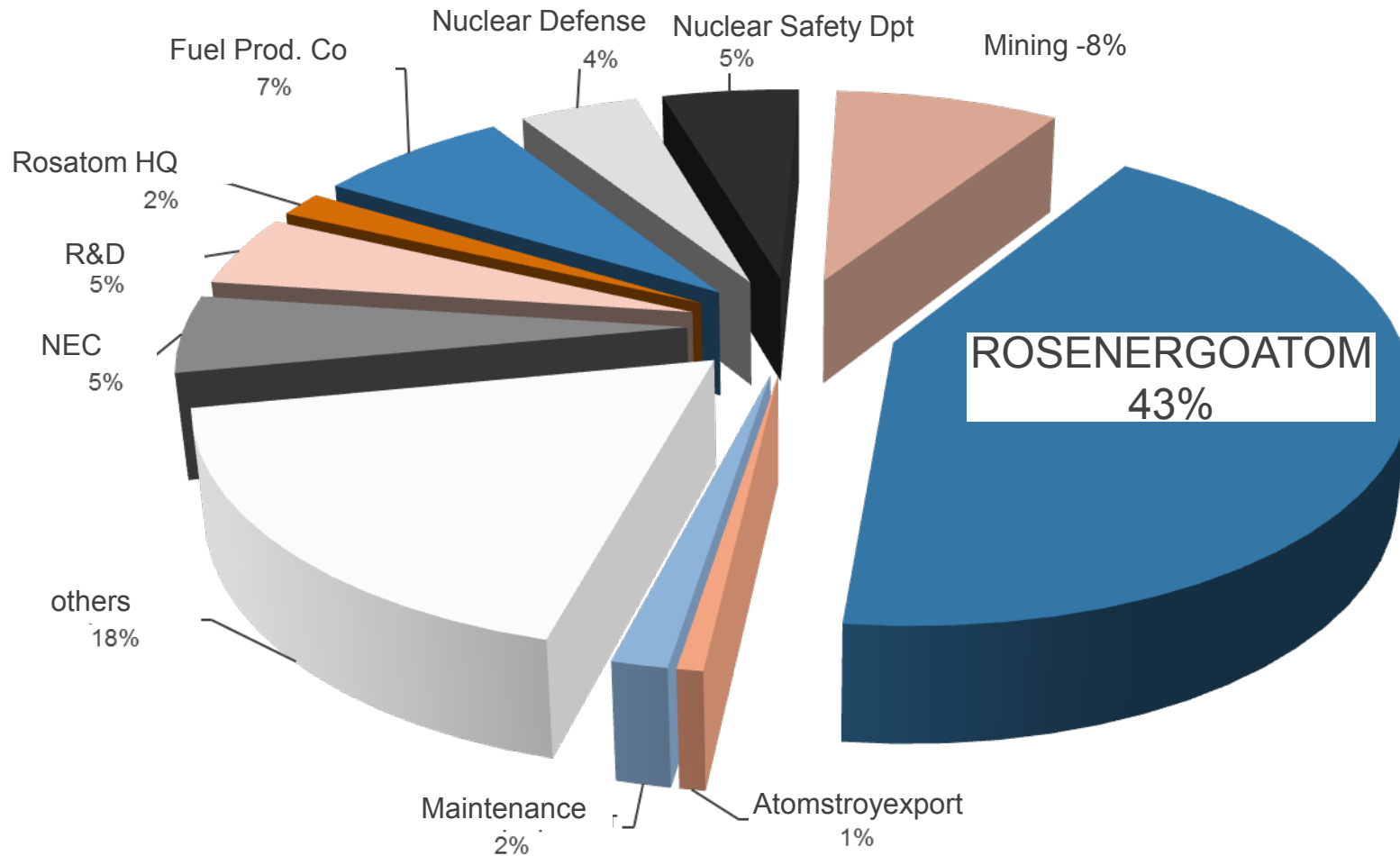


# ROSATOM CICE&T Training Dynamics



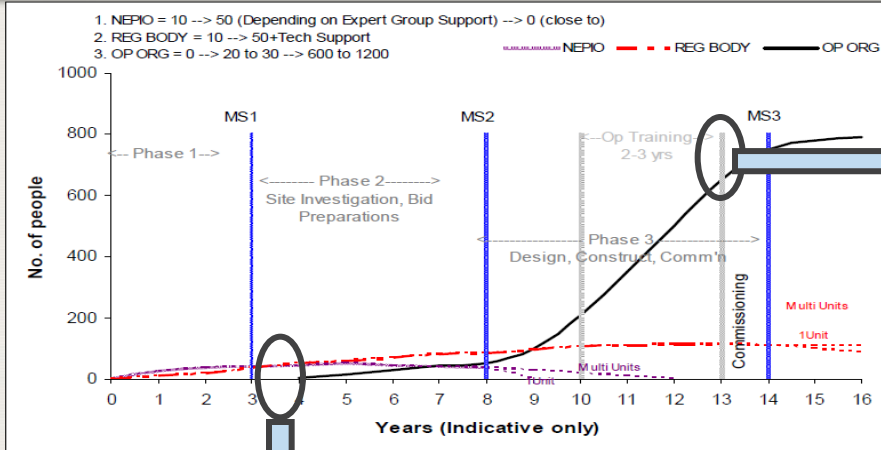


# Distribution of training services by ROSATOM divisions



# Essentials of HRD in Emerging Nuclear Countries

## Phasing the Training Programme

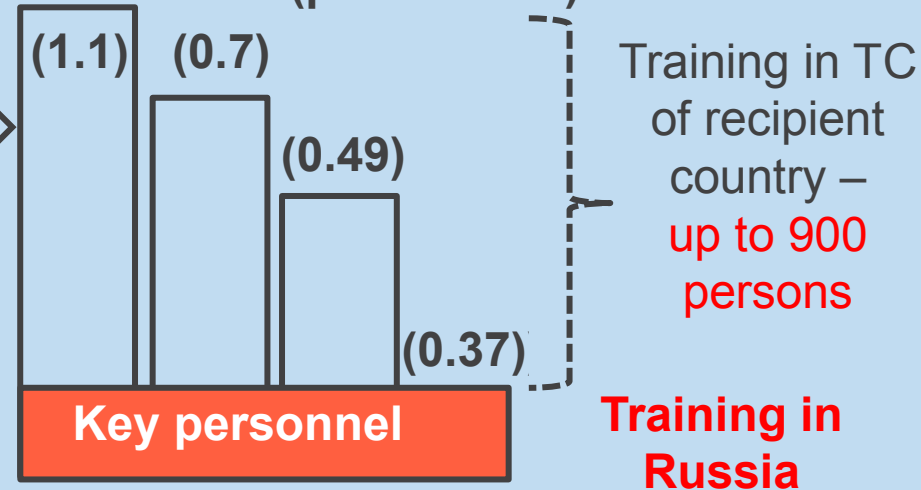


### Personnel for Nuclear Programme

- Nuclear Energy Program Implementing Organization (NEPIO) - **50 persons**
- Regulatory body (RB) – **70 persons**
- Operating organization (OO) – **150 persons**

**Total: 270 persons/country – training in Russia**

### NPP Staffing options (person/MW)



(operating personnel, mid-level and top managers):

- up to 200 persons per 1 unit**
- up to 300 persons per 2 unit**

# Forming the Pool of Russian Experts to Support the Nuclear Infrastructure Development in Emerging Nuclear Countries

## Goal:

**To build up a group** of Russian Experts for providing assistance to embarking countries.

**To learn the essentials** of the IAEA approach and recommendations and National nuclear power plans

**To work out the guidelines** for each infrastructure element

**To establish interaction** and understanding between Russian and their international counterparts on NI issues

## Outcome:

Road map for each element of NI: structure, functions, forms

**Training courses, E&T Services**, Internship, On-the-job-training

Assistance in development of regulations, "strategies & plans", etc

Specific solutions: "Centers" based on Russian experience

Obninsk, CICET, 3-7.12.2012



# ROSATOM Phase Based E&T Solutions

## Purpose:

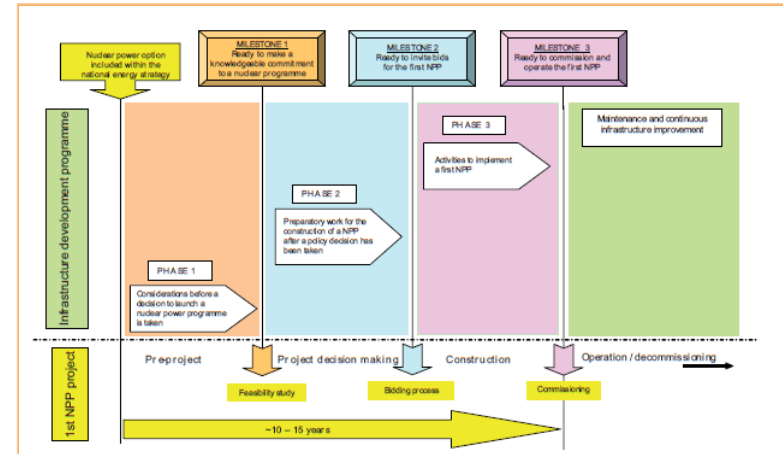
to provide support for new entrants on how-to-become-the- knowledgeable- customer at each phase of nuclear power programme development

## Targets:

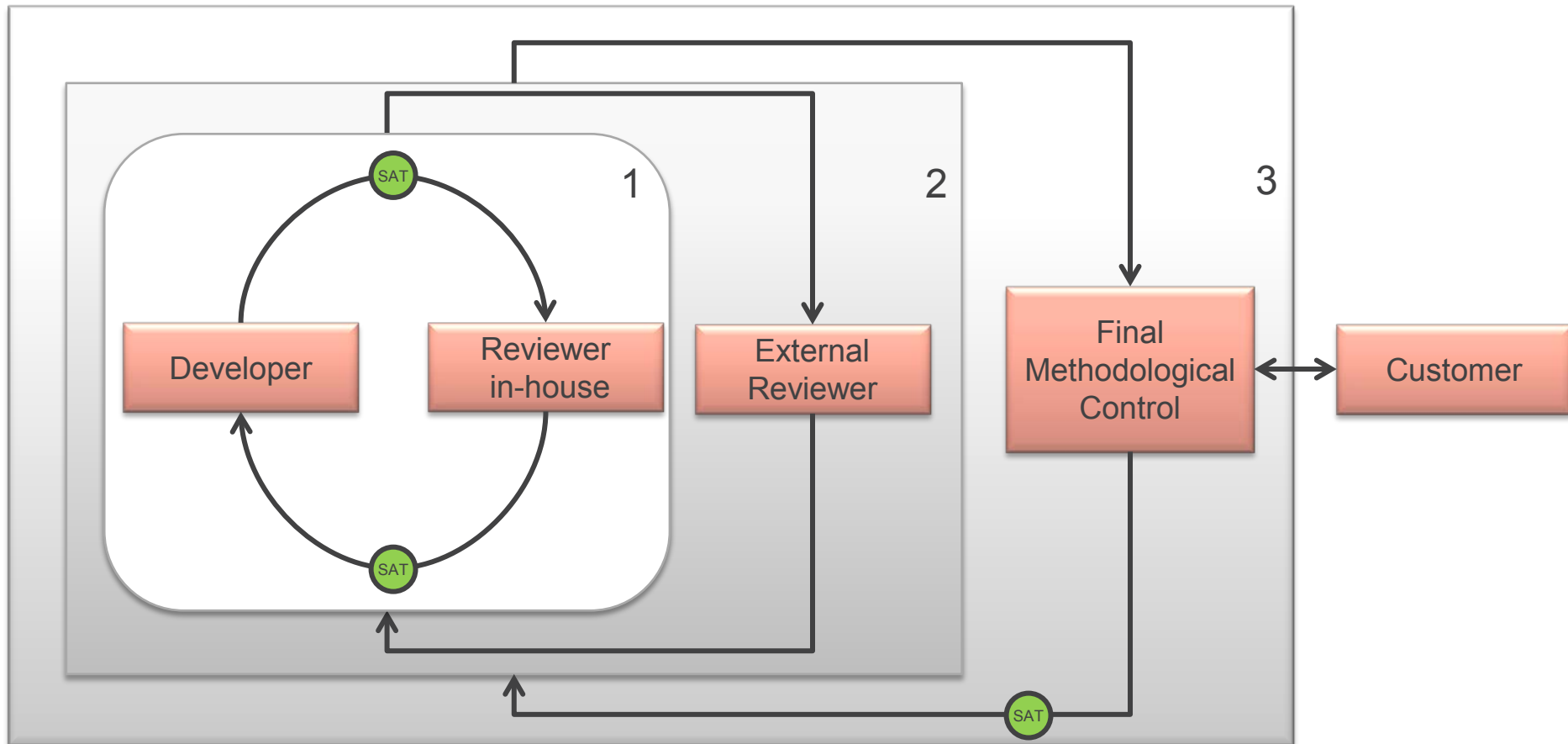
- Nuclear infrastructure organizations;
- Organizations involved in the process of localization (service organizations, technical support organizations, universities, etc)

## Products&Services:

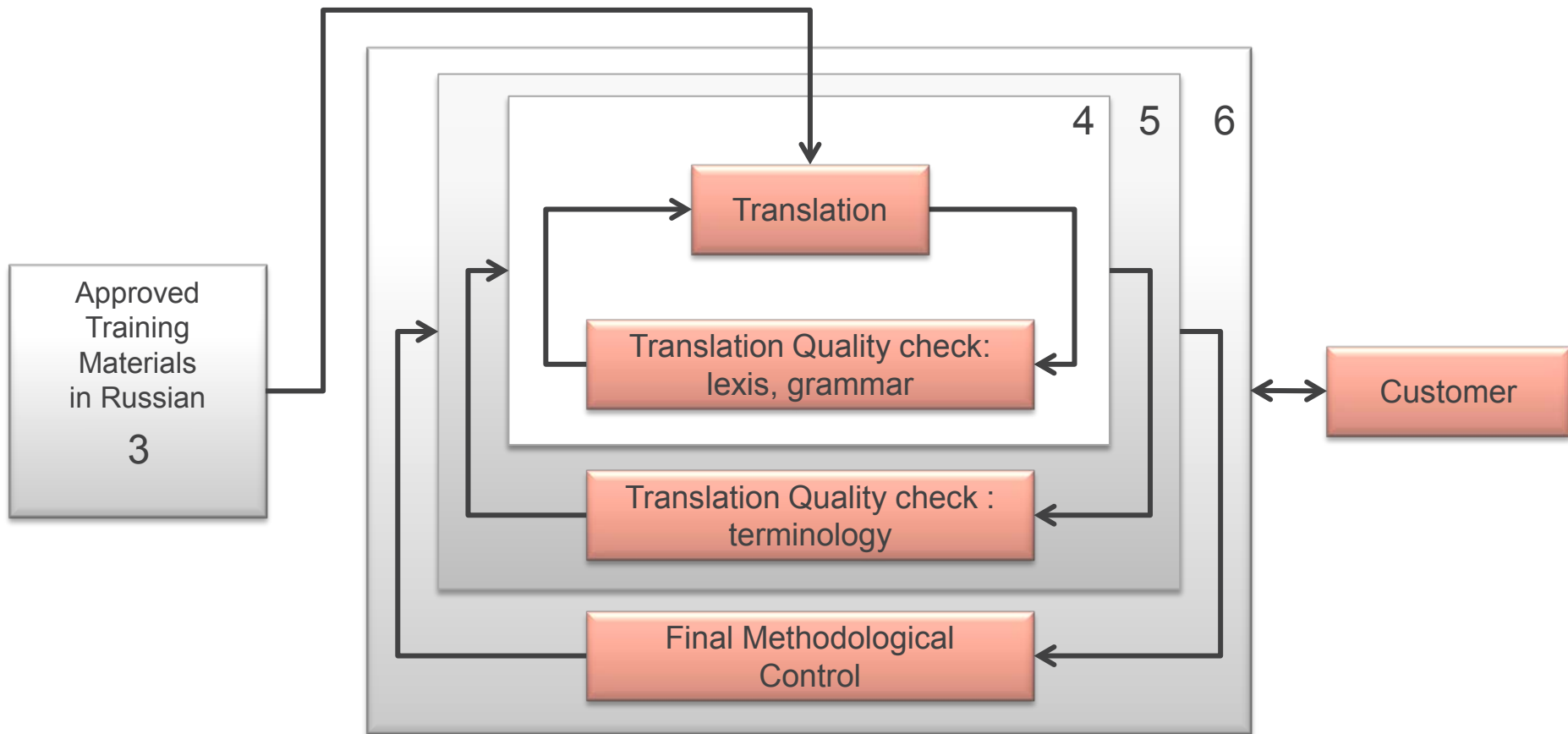
- Workshops to provide information on nuclear power technologies& associated services in new-entrants (**1-2 days**);
- Short-term training courses for skilled national personnel (**1 week- 1month**);
- Middle-term courses for building specific competencies (**1-6 months**)
- Long-term training for key personnel (**1-3 yrs**)
- University education in Russia (**2- 6 years**)
- Support of training localization (var)



# Developing of Training Materials in Russian



# Developing of Training Materials in English



# Training Programme Description (1/2)

## Course structure:

### 1. Course objectives

### 2. Course description

- Prior level of competence required
- Course modules
- Modules and training objectives description
- Requirements for the course implementation

### 3. Prerequisites

- Work experience
- Education
- Additional training
- Health requirements

### 4. Training evaluation

### 5. Competencies

JSC "Rosatom Overseas"	
<b>Course RP-11 "Radiation Safety and Health Protection"</b>	
<b>1. COURSE OBJECTIVES</b>	
To describe major national and international standards and requirements in radiation safety for nuclear power industry. To list basic principles of radiation safety. To describe the organization process for monitoring effective and equivalent doses of NPP personnel and public exposure. Identify the ways of decontamination and technical assurance of radiation protection at NPP.	
<b>2. COURSE DESCRIPTION</b>	
<b>2.1 PRIOR LEVEL OF COMPETENCE REQUIRED</b>	
1. The prior level of competence corresponds to the one associated with the following job positions: middle managers of nuclear infrastructure organizations, project team leaders, local design engineers.	
2. Fluent English	
<b>2.2 INFORMATION MODULE</b>	
Not applicable.	
<b>2.3 COURSE MODULES</b>	
The length of the course is 72 hours, including final examination. In the training schedule the following time is allocated to the listed modules:	
Module RP-11.01 Ionizing radiation sources	4 hours
Module RP-11.02 Biological effects of ionizing radiation and health effects	4 hours
Module RP-11.03 Dosimetry and assessment of risks associated with doses	8 hours
Module RP-11.04 Sources of external and internal exposure at NPP and specifics of radiation protection	4 hours
Module RP-11.05 Fundamentals and requirements for radiation safety standards	8 hours
Module RP-11.06 Radiation safety rules at NPP	9 hours
Module RP-11.07 Radioactive waste management	7 hours
Module RP-11.08 Radiation control. Dose reduction measures at NPP with WWER	8 hours
Module RP-11.09 Basics of ALARA principle	4 hours
Module RP-11.10 Investigation of emergency and accidental exposure of the personnel	5 hours
Module RP-11.11 Personal and public protection measures in case of radiation accidents	9 hours
Training programme Course: RP-11.01-11.11 File name: RP-11.TP01.E04	2 of 15

JSC "Rosatom Overseas"	
Final examination	2 hours
<b>2.4 MODULES DESCRIPTION</b>	
<b>Module RP-11.01</b>	
<b>Ionizing radiation sources</b>	
Terminal training objective:	
• Define the main ionizing radiation types from the point of view of their nature and interaction with matter.	
Enabling training objectives:	
• Specify the main characteristics of alpha-, beta-, and neutron radiation;	
• List the main characteristics of radionuclide sources;	
• Outline the basics about the interactions of radiation with matter.	
This training module includes:	
Lesson RP-11.01.1 Characteristics of nuclei and nuclear transformations	
Lesson RP-11.01.2 Radiation spectra. Characteristics of radionuclide sources	
Lesson RP-11.01.3 Primary interaction of ionizing radiation with matter: Radiation energy transfer	
The training on the module takes 4 hours, including 4 hours of lectures.	
<b>Module RP-11.02</b>	
<b>Biological effects of ionizing radiation and health effects</b>	
Terminal training objectives:	
• Using the information about ionizing radiation, explain the nature and features of biological effects of ionizing radiation and health effects.	
Enabling training objectives:	
• Describe the radiation effects at the cellular level;	
• Describe somatic and genetic effects as consequences of human exposure;	
• Describe the forms of a acute radiation syndrome;	
• Explain the effects of radionuclides intake.	
This training module includes:	
Lesson RP-11.02.1 Modern view on biological effects of ionizing radiation. Health effects	
Lesson RP-11.02.2 Acute and chronic radiation syndromes	
Lesson RP-11.02.3 Biological effects of radionuclides intake and external exposure dose	
The training on the module takes 4 hours, including 3 hours of lectures and 1 hour of practice.	
<b>Module RP-11.03</b>	
<b>Dosimetry and assessment of risks associated with doses</b>	
Terminal training objective:	
• Explain the concept of risk in the area of radiation safety;	
• Describe the dosimetry basics for gamma- and neutron radiation.	
Enabling training objectives:	
• List the specific ways to protect against various types of radiation;	
Training programme Course: RP-11.01-11.11 File name: RP-11.TP01.E04	3 of 15

JSC "Rosatom Overseas"	
<b>2.5 REQUIREMENTS FOR THE COURSE IMPLEMENTATION</b>	
During the training the following requirements should be met:	
1. The adherence to the content of modules and lessons included in the course should be provided (see Appendix 1).	
2. Training should be conducted in a classroom equipped in accordance with the requirements.	
3. Training should be conducted in accordance with the training objectives, content of modules included in the training course (list of competences is given in Appendix 2). Upon completion of training on the course, final examination should be carried out.	
<b>3. PREREQUISITES</b>	
To admit the trainees for the course the following prerequisites are specified:	
<b>3.1 WORK EXPERIENCE</b>	
Work experience in the position of the middle level manager of nuclear infrastructure organizations, project team leader not less than 2 years.	
<b>3.2 EDUCATION</b>	
Technical and/or business education with a degree not lower than Master.	
<b>3.3 ADDITIONAL TRAINING</b>	
Fluent English.	
<b>3.4 HEALTH REQUIREMENTS</b>	
Requirements are not specified.	
<b>4. TRAINING EVALUATION</b>	
Evaluation of the training at the end of each module is carried out on the basis of terminal and enabling training objectives in the form of an oral questioning.	
Upon completion of the training course each candidate should pass a written test.	
Upon completion of training on the programme final examination should be taken.	
<b>5. COMPETENCIES</b>	
See Appendix 2.	
Training programme Course: RP-11.01-11.11 File name: RP-11.TP01.E04	8 of 15

# Training Programme Description (2/2)

## Curriculum

## List of competencies

## Glossary

JSC "Rosatom Overseas"

### Appendix 1 – Curriculum RP-11 "Radiation Safety and Health Protection"

**Objectives** Describe major national and international standards and requirements in radiation safety for nuclear power industry. List basic principles of radiation safety. Describe the organization process of monitoring effective and equivalent doses of NPP personnel and public exposure. Name the ways of administration and technical assurance of radiation protection at NPP.

**Category of trainees** Specialists of nuclear power industry and managerial personnel of organizations developing programs on nuclear energy technology

**Duration** 72 hours 2 week \_\_\_\_\_ months

**Mode** 8 hours/day

№	Modules	Total hours	Including full-time		Form of control
			lectures	practice	
1	<b>Module PR-11.01 Ionizing radiation sources</b>	4	4	0	<b>Oral questioning</b>
1.1	Lesson PR-11.01.1 Characteristics of nuclei and nuclear transformations	-	1	-	-
1.2	Lesson PR-11.01.2 Radiation spectra. Characteristics of radionuclide sources	-	1	-	-
1.3	Lesson PR-11.01.3 Primary interaction of ionizing radiation with matter. Radiation energy transfer	-	2	-	-
2	<b>Module PR-11.02 Biological effects of ionizing radiation and health effects</b>	4	3	1	<b>Oral questioning</b>
2.1	Lesson PR-11.02.1 Modern view on biological effects of ionizing radiation. Health effects	-	1	0.5	-
2.2	Lesson PR-11.02.2 Acute and chronic radiation syndromes	-	1	0.5	-
2.3	Lesson PR-11.02.3 Biological effects of radionuclides intake and internal exposure dose	-	1	-	-
3	<b>Module PR-11.03 Dosimetry and assessment of risks associated with doses</b>	8	5	3	<b>Oral questioning</b>
3.1	Lesson PR-11.03.1	-	0.5	1	-

Training programme  
Contract: 9/2070-21  
File name: RP-11 TP01 E 04c

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JSC "Rosatom Overseas"

### Appendix – 2 List of competencies included in the programme of the course RP-11 "Radiation Safety and Health Protection"

Knowledge how to apply basic modern national standards and requirements for radiation safety in nuclear power industry
Application of ALARA methodology during activities associated to radiation risks
Grasping the principles of radiation safety at nuclear facilities
Possessing the principles of the organization of control of effective and equivalent doses of NPP personnel and the public radiation
Administrative and technical assurance of radiation safety at NPPs

Training programme  
Contract: 9/2070-21  
File name: RP-11 TP01 E 04c

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JSC "Rosatom Overseas"

### Appendix – 3 Glossary for the programme of the course RP-11 "Radiation Safety and Health Protection"

NRB-99/09 – Normy Radiatsionnoy Bezopasnosti 99/09, rus. Нормы Радиационной Безопасности НРБ-99/09 СанПин 2.6.1.2523-09, transl. Radiation Safety Standards 99/09

OSPORB-99/10 – Osnovnie Sanitarniye Pravila Obespecheniya Radiatsionnoy Bezopasnosti 99/10, rus. Основные Санитарные Правила Обеспечения Радиационной Безопасности ОСПОБ-99/10 СанПин 2.6.1.2612-10, transl. Principal Sanitary Rules on the Radiation Safety Ensuring 99/2010

SP AS-03 – Sanitarniye pravila proyektirovaniya i ekspluatatsii atomnykh stantsiy, rus. Санитарные правила проектирования и эксплуатации атомных станций' СП АС-03 СанПин 2.6.1.24-03, transl. Sanitary rules on design and operation of nuclear plants 2003








SPORO-2002–Sanitarniye pravila obrascheniya s radioaktivnymi otkhodami 2002, rus. Санитарные правила обращения с радиоактивными отходами (СПОРО-2002) СП 2.6.6.1168-02, transl. Sanitary rules on radioactive waste management 2002

Training programme  
Contract: 9/2070-21  
File name: RP-11 TP01 E 04c

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# Training Courses' Development in 2013 Ordered by "Rusatom Overseas"

No	Course Title	Language	Duration	Training materials
1	Radiation Safety and Health Protection		72 h	TP, HB, PPTs, LP
2	Specifics of WWER Design: Safety Issues		144 h	TP, HB, PPTs, LP
3	Safety Analysis for NPP with WWER Reactors		72 h	TP, HB, PPTs, LP
4	Policy on Decommissioning and Regulatory Control		36 h	TP, HB, PPTs, LP
5	NPP Safety Assessment Based on Preliminary Safety Analysis Report		72 h	TP, HB, PPTs, LP
6	Financial Aspects of NPP Construction		72 h	TP, HB, PPTs, LP
7	Risk Assessment and Risk Management		36 h	TP, HB, PPTs, LP

# NKM Issues in Training Course Development

Rosatom Central Institute for Continuing Education and Training (ROSATOM-CICE&T)

From education to competence build we pave the way to career success for nuclear professionals



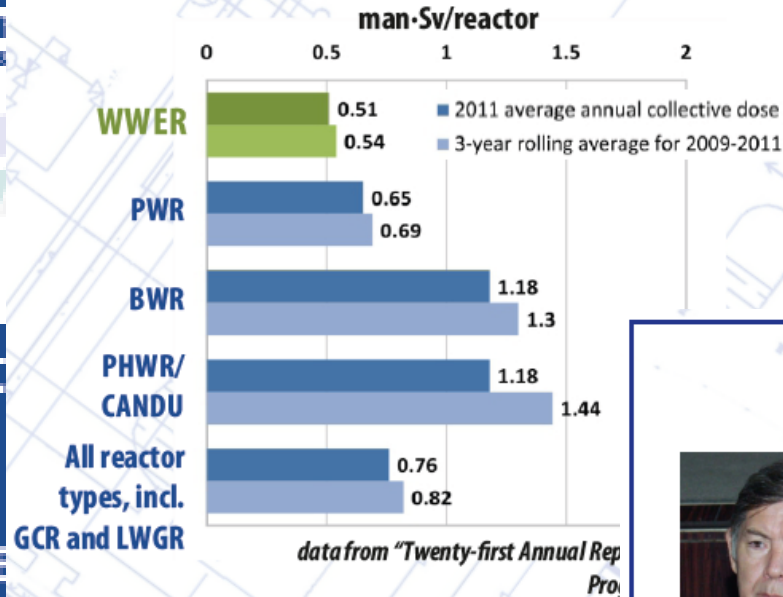
International Training Course:

**Radiation safety and health protection**  
(Practical case of WWER)

- WWERs have the lowest occupational exposure level comparing to other reactor types worldwide
- The course is based on the unique Russian experience (since 1940s) and international best practices in radiation safety, radiation protection and accident management

Ozninsk - 2014

## WWER – THE LOWEST OCCUPATIONAL EXPOSURE LEVEL



## EXPERTS INVOLVEMENT and the course team



**Solovyev A.A.**

**Expert of the course**  
Head of the training center  
"Nuclear and radiation safety"  
Rosatom CICE&T, former Deputy  
Director for Safety of Bushehr NPP



**Vaizer V.I.**

**The course reviewer**  
Head of Radiation safety  
department of A.I. Leypunsky  
Institute for Physics and Power  
Engineering, member of  
Radiation Safety  
Methodological Board of  
Rosatom



**Filipyev I.S.**

**The course developer**  
Specialist of International Center  
for NPP Personnel Training,  
Rosatom CICE&T

# Training in Cooperation with ENEN

(European Nuclear Education Network Association)

## Engineering aspects of nuclear fuel fabrication: from mining to manufacturing fuel assemblies



POCATOM

Training dates: 21.05– 16.05.2012.  
Training language: English.  
Trainees : Italy (2),  
Romania (4),  
Slovakia (2),  
IPPE (2),  
MEPhI (1)  
Total : 11 persons

Scope: the course aims to familiarize postgraduates and specialists from Europe with specific features of Russian technologies of nuclear fuel fabrication.

Content: the course comprises lectures, practical assignments and technical tour of Mashinostroitelny Zavod, Electrostal (Fuel company “TVEL”).

Duration: 36 academic hours (following the test the trainees were awarded ECTS grades )

# Bilateral Cooperation with VN Organizations in 2012

## Basic course on safety of nuclear technologies



Training dates: 17.09– 14.12. 2012.  
Training language: English.  
Trainees: VAEA (3),  
VINATOM (2),  
VARANS (5)  
Total: 10 persons

## Introductory course in simulator application for safety analysis



Training dates: 19.11– 14.12. 2012.  
Training language: English.  
Trainees: VARANS (6),  
Total: 6 persons

**Courses were developed in cooperation SEC "NRS", IBRAE, GIDROPRESS and other Russian institutions**

# Signing Practical Arrangements Between ROSATOM Subsidiaries and the IAEA

19.09.2011



Left to right  
V.G. Asmolov, First Deputy of General Director of Rosenergoatom;  
A.V. Bychkov, Deputy Director General of the IAEA,  
Yu.N. Seleznev, Rector of CICE&T

Objectives:

Rosenergoatom, CICE&T and IAEA reached understanding that enhancing interaction between them requires cooperation in the following areas:

- Exchange and dissemination of information, including release of joint publications;
- Mutual support in establishing **training courses to develop human resources** for countries embarking on the way of developing nuclear power;
- Organizing joint missions to evaluate requests from recipient-countries

# Short-term Training Courses for Bangladesh Nuclear Infrastructure Development

in cooperation with IAEA

**Establishing Nuclear Power: Siting, Reactor Design, Quality Assurance**  
**15-26 April 2013**



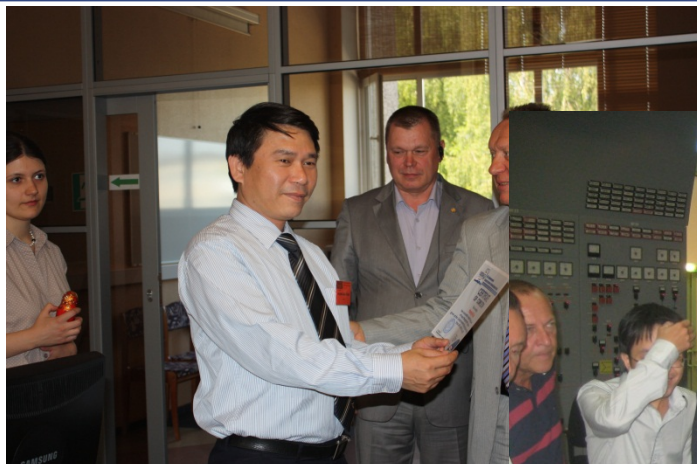
**Project Management for NPP Construction**  
**04- 17 Dec. 2011**



**Project Management for NPP Construction**  
**31 May– 07 June, 2011**

# Cooperation with the IAEA: Training Top Managers in Nuclear Power Program for Vietnam in 2011

5- 18 June 2011



20- 27 August 2011



02- 15 October 2011

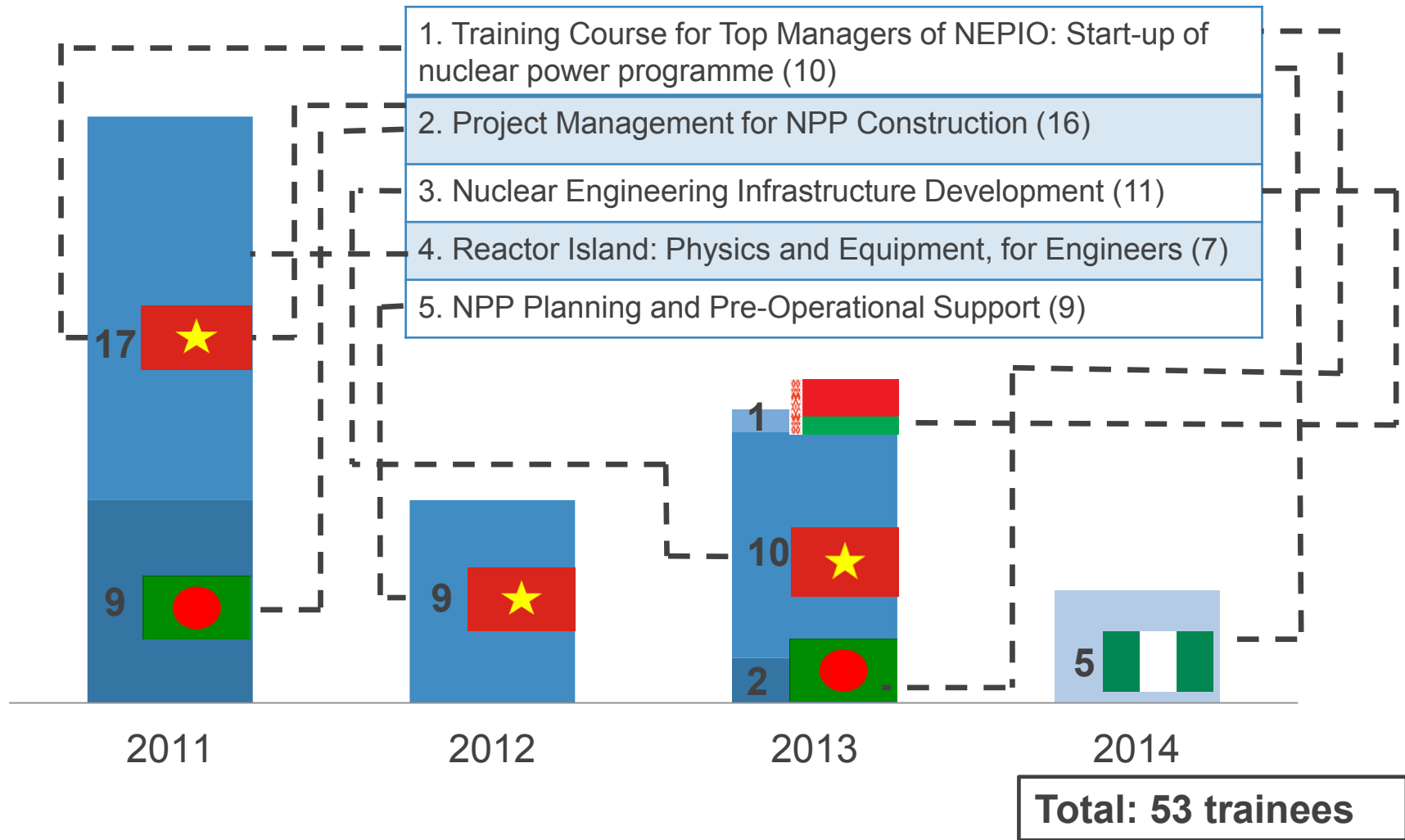


**Course:  
Project Management  
for NPP under  
Construction**

**Course:  
Reactor physics for  
engineers**

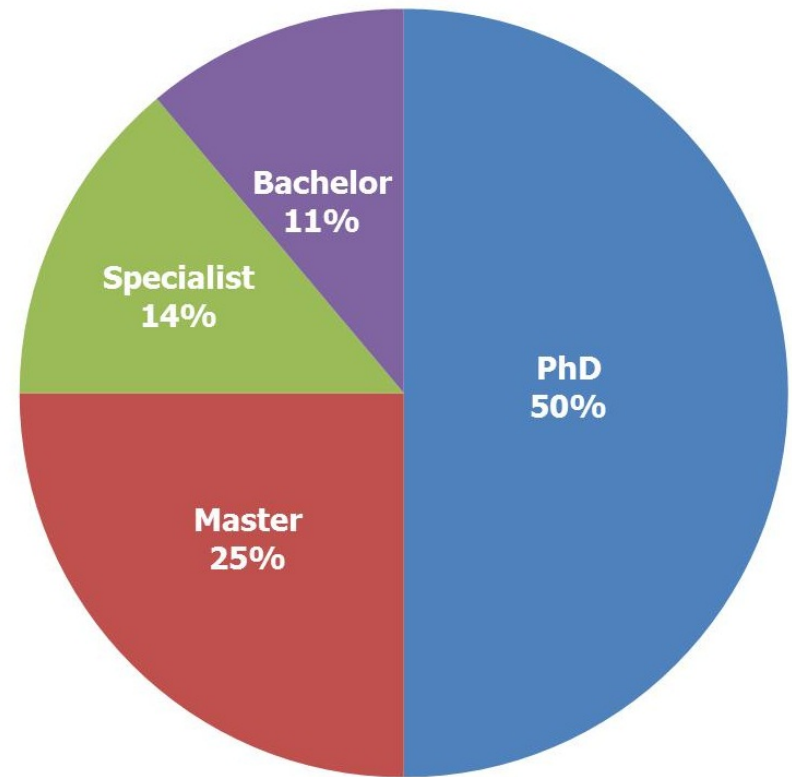
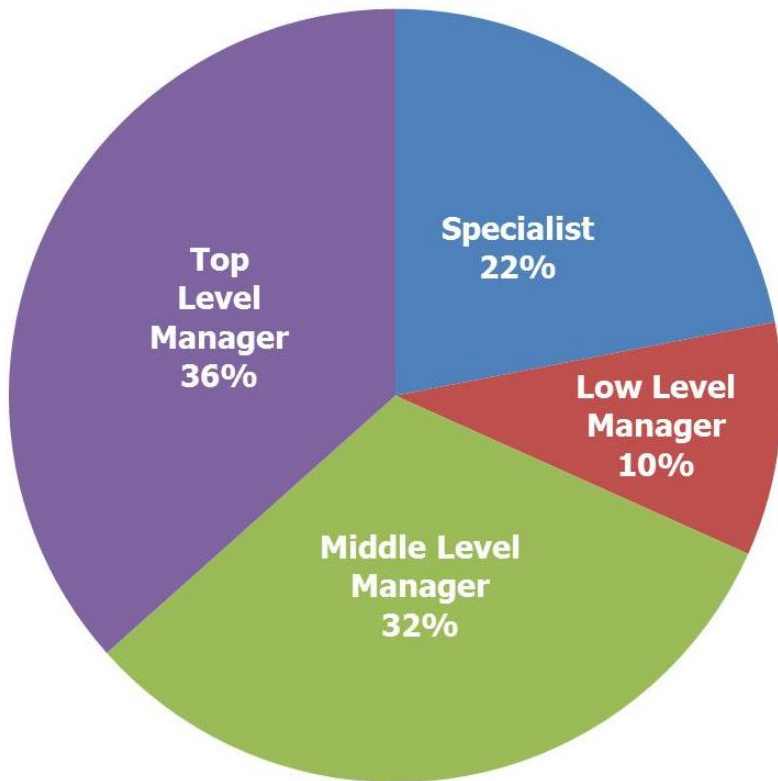
**Course for NEPIO:  
Initialization of national  
nuclear power  
programmes**

# Training activities in ROSATOM CICE&T provided in cooperation with TC IAEA





# Professional (left) and educational (right) background of national nuclear infrastructure personnel visited Rosatom-CICE&T in 2011-2014



# Lesson learned

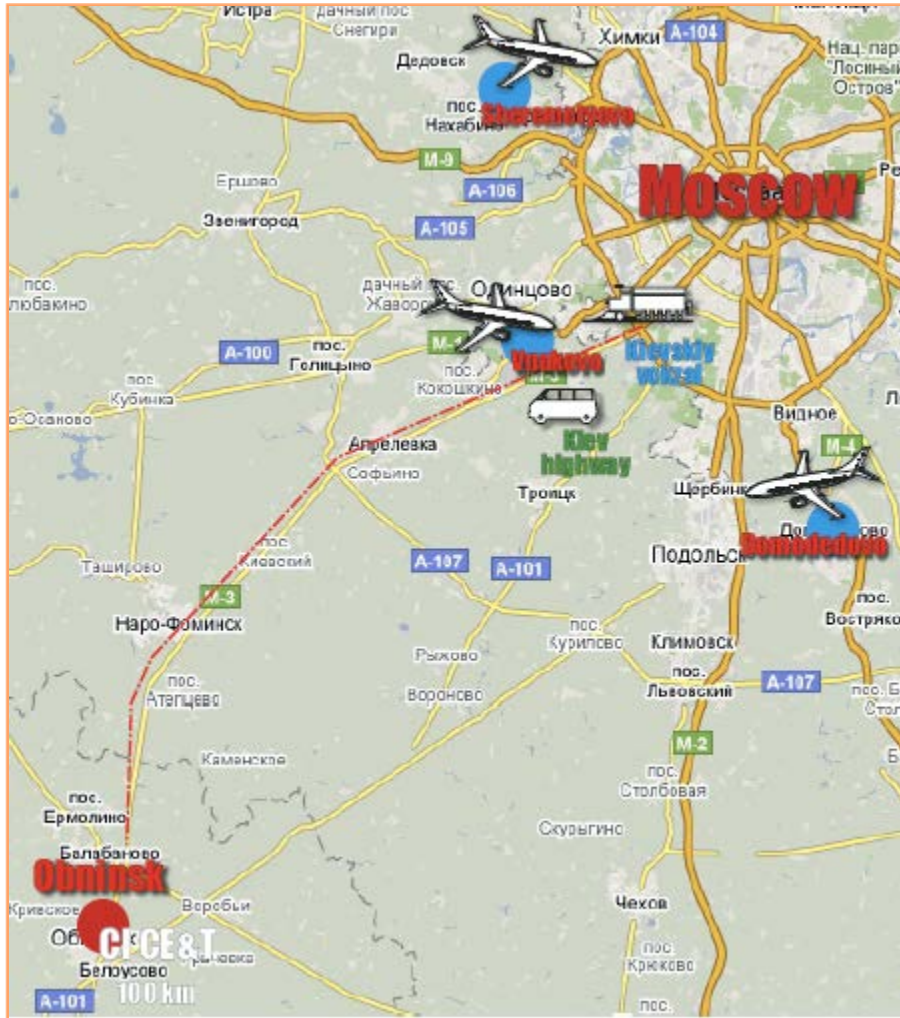
***Of highest priority is the investigation of NPP staffing options and associated competences of NPP personnel*** (both are very much vendor dependent).

This would help to facilitate self-evaluation of national nuclear infrastructure development and form the integrated work plan in the HRD area including training schemes of the key operating personnel in vendor country.

Related to this issue is the necessity ***to form the joint working group for elaboration on the HRD Roadmap***

# Thank You for Your Attention! Welcome to Rosatom CICET

<http://rosatom-cicet.ru/>



[http://rosatom-cicet.ru/?page\\_id=98](http://rosatom-cicet.ru/?page_id=98)



**CENTRAL INSTITUTE FOR CONTINUING EDUCATION & TRAINING  
INTERNATIONAL TRAINING CENTRE**



**CAPACITY BUILDING FOR NATIONAL  
NUCLEAR INFRASTRUCTURE  
IN EMERGING NUCLEAR COUNTRIES**



**CATALOGUE  
OF TRAINING  
PROGRAMMES**  
OBNINSK - RUSSIA - 2012