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The International Science and Technology Center (ISTC) and ISTC Projects Related to Research Reactors

(Information Review)

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ABSTRACT

1. ISTC - history, activities, outlook.

The ISTC is an intergovernmental organization established by agreement between the Russian Federation, the European Union, Japan, and the United States. Since 1994, Finland, Sweden, Norway, Georgia, Armenia, Belarus, Kazakhstan and the Kyrgyz Republic have acceded to the Agreement and Statute. At present, the Republic of Korea is finishing the process of accession to the ISTC.
All work of the ISTC is aimed at the goals defined in the ISTC Agreement:

- To give CIS weapons scientists, particularly those who possess knowledge and skills related to weapons of mass destruction and their delivery systems, the opportunities to redirect their talents to peaceful activities;
- To contribute to solving national and international technical problems;
- To support the transition to market-based economies;
- To support basic and applied research;
- To help integrate CIS weapons scientists into the international scientific community.

The projects may be funded both through governmental funds of the Funding Parties specified for the ISTC, and by organizations, nominated as Funding Partners of the ISTC. According to the ISTC Statute, approved by the appropriate national organizations, funds used within ISTC projects are exempt from CIS taxes.
As of March 1998, more than 1500 proposals had been submitted to the Center, of which 541 were approved for funding, for a total value of approximately US$165 million. The number of scientists and engineers participating in the projects is more than 17,000.

2. Projects Related to Research Reactors.

There are about 20 funded and as yet nonfunded projects related to various problems of research reactors. Many of them address safety issues.
Information review of the results and plans of both ongoing projects and as yet nonfunded proposals related to research reactors will be presented with the aim assisting international researchers to establish partnerships or collaboration with ISTC projects.
The following groups of ISTC projects will be represented:

1. Complex Computer Simulators for Research Reactors;
2. Reactor Facility Decommissioning;
3. Neutron Sources for Medicine;
4. Medical Radioisotope Production by Research Reactors;
5. Research Reactors for Examination of Physics and Materials.

The International Science and Technology Center (ISTC) and ISTC Projects Related to Research Reactors *(Information Review)*

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1. ISTC - history, activities, outlook.

The ISTC is an intergovernmental organization established by agreement between the Russian Federation, the European Union, Japan, and the United States. Since 1994, Finland, Sweden, Norway, Georgia, Armenia, Belarus, Kazakhstan, and the Kyrgyz Republic have acceded to the Agreement and Statute. At present, the Republic of Korea is finishing the process of accession to the ISTC.
The Center was created to give scientists and engineers, who possess knowledge and skills related to weapons of mass destruction or missile delivery systems in Russia and other CIS countries, the opportunities to redirect their talents to civilian activities. The ISTC accomplishes its mission by developing, funding, and monitoring research projects with peaceful applications, sponsoring and organizing seminars, training, and promoting the valorization of the project results. ISTC projects cover a wide range of science and technology areas, many of which address problems of global importance such as

- Environmental radiation monitoring
- Improved safety for nuclear reactors
- Improved methods of nuclear waste management
- Vaccines for bacterial and viral diseases
- Treatment of heart disease, cancer and other illnesses
- Improvements in civil aviation
- Improved concepts for future energy production

One of the main goals of the ISTC is the integration of scientists and engineers formerly engaged in the development of weapons of mass destruction into the international scientific community. To this end, the ISTC encourages, supports, and facilitates international scientific collaboration.
The ISTC implements other activities, such as seminar programs, the Project Development Grant program, and training programs.
The ISTC has organized 12 seminars since 1994, three of which were held in 1997 to promote exchange and collaboration in a wide range of research fields between former weapons developers in the CIS and their counterparts around the world.
The Project Development Grants program assists CIS weapons specialists in seeking foreign collaborators for research projects.
The Secretariat has now implemented a Business Management Training program to educate scientists in the commercialization process for new technologies.
The ISTC released its "Promising Research Abstracts" database on CD-ROM. The database permits companies to search numerous research topics and find highly qualified project teams at institutes and centers throughout Russia and the CIS.
The projects may be funded both through governmental funds from the Funding Parties that are specified for the ISTC and by organizations nominated as Funding Partners of the ISTC. Fifteen new Partners have already begun funding ISTC projects in a range of science and technology fields with a

total value of over one million dollars. According to the ISTC Statute approved by the appropriate national organizations, funds used within ISTC projects are exempt from CIS taxes.
The ISTC became operational in March 1994. As of March 1998, more than 1500 proposals had been submitted to the Center, of which 541 were approved for funding, for a total value of approximately US$166 million. About 40 new proposals are received each month. More than 280 institutions and 17,000 specialists have received grants from the ISTC. All information about the ISTC can be found at Website www.istc.ru.

2. Projects Related to Research Reactors.

As of March 1998, 22 proposals related to research reactors were registered by the ISTC Secretariat. Ten of these projects have been approved by the Governing Board, and an amount of over $3 million has been allocated. The most active Financing Parties are the European Union, the United States and Japan (see Table1).
The majority of projects submitted are related to the following technological sub-areas:

- Complex Computer Simulators for Research Reactors;
- Reactor Facility Decommissioning;
- Neutron Sources for Medicine;
- Medical Radioisotope Production by Research Reactors;
- Research Reactors for Examination of Physics and Materials

About 25 Russian and Kazakh institutions are involved as project leaders or participants. Table 2 shows the main leading institutes, the projects they head, and the projects in which they participate. The following institutions have been the most active in submitting proposals to the ISTC: NIKIET (Moscow), IPPE (Obninsk), Kurchatov R.C. (Moscow), VNIIEF (Arzamas-16), VNIITF, (Chelyabinsk-70) and MEPhI (Moscow). The essential feature of ISTC Projects is the participation of formerly closed weapons laboratories in terms of their personnel, research reactors, and accumulated knowledge in measurement and analysis techniques.
About 40 institutes, companies, and governmental organizations from the US, the European Union, and Japan have supported and are participating in ongoing projects as collaborators. Table 3 shows the foreign collaborators in ongoing projects. Some of them are ISTC Partners, and others have the potential to become ISTC Partners in the future.
The following is a short description of the projects, which are divided into groups. The name of the leading institute is shown in brackets beneath the project title. Projects are designated as either Funded (F) or Nonfunded (NF).

Complex Computer Simulators for Research Reactors

#321 Functional Training–Simulator Complex for the PIK Research Reactor
(FTSC PIK).
(NPI, Gatchina). F(EU)
A computer complex will be developed to study different regimes of experimental reactors using thermal neutrons.

#858 Multifunctional Computer Complex for Research Reactors
(NIIAR, Dimitrovgrad). NF
Fast reactors and fuel cycle components will be simulated for training.

Reactor Facility Decommissioning

#779 Development of Technology for Dismantling the BR-10 Reactor and Processing Radioactive Wastes before Utilization.

(IPPE, Obninsk) F(EU)
Acceptable technology for radioactive sodium cleaning will be chosen, developed, and tested.

#465 Ensuring Safety during Decommissioning of Reactor Installations used for Civil and Military Applications (Monograph)
Kurchatov R.C., Moscow F(EU, USA, Sweden)
Different problems of decommissioning nuclear reactors and approaches to solving them will be summarized in the monograph.

#K-048 Development of Technology for Decommissioning a Reactor Facility with an RA Research Reactor at the Institute of Atomic Energy of the National Nuclear Center of the Republic of Kazakhstan.
(Institute of Atomic Energy of NNC), Kurchatov, Kazakhstan) F(USA)
Specific problems and technical decisions of unloading highly enriched fuel will be studied.

Research Reactors for Examination of Physics and Materials.

#371 Critical Experiments for Pu Utilization in LWR-Type Reactors Using IPPE Facilities.
(IPPE, Obninsk) F(EU, Japan, Sweden)
The purpose of the project is reasoning of nuclear safety of VVER power reactors in the case of their fueling by the weapon-grade or/and civilian plutonium. The project plans to reason, develop and create a new critical stand SUPR and related experimental program including carrying out a set of the pre-SUPR experiments on the IPPE's stand BFS with partial plutonium load.
#442 Shut Down Reactor Transformation into Subcritical Neutron Source.
Control and Safety System Substantiation and Development
(ITEF, Moscow) NF
The main goal of the Project is to develop and to construct the full-scale model of an accelerator-driven subcritical pulsed neutron source and to research its neutron and physical parameters, safety of the operating regimes.
#0487 Development and Computational-Experimental Validation of the Concept of Self-Quenching Multi-channel Pulse Graphite Reactor (MIGR) for the Studies on Nuclear Reactor Safety.
(VNIITF, Snezhinsk (Chelyabinsk-70)) NF
The main goal of the project –development of basic design solution and outline of experimental complex on the base of research pulse-static reactor of big output- Multi-Channel Pulse (Impulse) Graphite Reactor (MIGR).

#517 Experimental Studies of Reactor Radiation Scattering in the Atmosphere.

(NIKIET, Moscow) F(Japan)
Data of skyshine scattering to be obtained during experiments with the unique test reactors IR and RA in Semipalatinsk, Kazahstan, will help to improve environmental protection and conditions for the population living close nuclear units
#534 Combined Investigation of Advanced Uranium Dioxide and Mixed Uranium–Plutonium Dioxide Fuel Properties for Predicting Performance and Operating Characteristics and Verifying Calculation Models of Fuel Elements for Operative and Advanced Atomic Station Power Reactors
(VNIINM, Moscow) F(EU)
The plan includes in-pile experiments and on-site measurements at the NIIAR research reactor.
0614 Numerical Simulation of Nuclear Fuel Behavior during Accidents and Normal Operation.
(VNIIEF, Sarov (Arzamas-16)) F(USA)
Verification of developed codes with using of VNIIEF experimental data (reactor in-pile expriments with failures of fuel elements).

682 The Creation of Diagnostic Systems for Pulsed Neutron Sources
(JINR, Dubna) F(Japan)
The project aims to develop the following systems for the IBR-2 pulse reactor, located at the leading institute - JINR, Dubna: 1) diagnostic system for reactor parameters; 2) diagnostic system for mechanical vibration; and 3) measurement system for power pulse parameters
#949 The Nuclear–Thermal Method of Pulse Loads for Fuel Rod Tests to Ensure Nuclear Power Reactor Safety
(Kurchatov R.C. Moscow) NF
The results of fuel elements study under pulse load conditions in Russia at the reactors HIDRA (pulse homogeneous reactor which uses water solution of uranil sulfate as a fuel), and also KI (KIAE), IGR (Kazahstan).
#974 The Effect of Fuel Cladding Lamination in Nuclear Power Reactors in Emergency Situations
(NIKIET, Moscow) NF
The experiments of #974, #987 and #988 will be carried out at the IVV-2M reactor at NIKIET/RDIPE.
#987 Investigation of the Influence of Low-Temperature Irradiation on Austenitic Steels and Development of a Method for Predicting Their Physical and Mechanical Properties
(NIKIET (Sverdlovsk Branch), Zarechny) NF
#988 Reactor Tests in a Hydrogen Medium and Post-Reactor Investigations of Material Properties of a Nuclear Power Plant for Space Flights
(NIKIET, Moscow) NF

Neutron Sources for Medicine

#144 Development of a Three-Dimensional Dosimetry Planning System for Radiation Therapy.
(MEPhI, Moscow) F(EU)

#1079 System for Optimizing Radiation Therapy Planning by Photon and Electron Beams on the Basis of a Pencil Beam Algorithm.
(MEPhI, Moscow) NF
Verification of gamma and neutron dose predictions by Monte Carlo calculation methods for different radiotherapy needs.

#336 Research on Improving Methods and Means for Neutron Therapy.
(IPPE, Obninsk) NF
Designs of special-purpose experimental fast reactors with irradiation channels for medicine. Modification of an existing experimental reactor for verification of design concepts. The practical experience gained from using the BR-10 reactor at IPPE for cancer therapy will be used.

#1059 Feasibility Study for the Creation of a Neutron Therapy Center on the Basis of Nuclear Reactors
(MRRC, Obninsk) NF
Principal aspects, R&D needs, and technical requirements for designing a specialized reactor, beam parameters, doses, therapy approaches, optimization of the general setup of a typical radiomedical center, etc. will be analyzed with collaborators.

Medical Radioisotope Production by Research Reactors

#916 Development of Technologies for Producing High-Purity Radioactive Isotopes for Medical and Biological Applications on the Basis of a Fast Neutron Research Reactor.
(IPPE, Obninsk) NF

A new highly effective technology based on fast neutron physics allows production of extremely high-purity radioisotopes .

#920 Development of Highly Effective Low-Waste Technology Based on the Use of Molten Fluoride Salts for Producing Fission-Fragment ^{99}Mo for Medical Purposes
(Kurchatov R.C. Moscow) NF
Original technology shows promise as a simpler method of producing ^{99}Mo isotope for medicine.

The goal of this presentation is to bring ISTC activities in the area of research reactors to the attention of specialists and to elicit possible cooperation in both proposed and potential future projects.

The abstracts of all projects and project proposals related to research reactors are listed in Attachment 1 in order to attract the attention of potential foreign collaborators and financing partners and to stimulate interest in international collaboration.
The ISTC Secretariat is ready to provide information about the fields of activity of high-level CIS research institutes and companies, which could be useful in establishing contacts for the development of new joint ISTC projects.

Table 1. Projects Related to Research Reactor Funding by Parties.

Project #	European Union (EU)	United States	Japan	Sweden	Total ($K)
144	198,535	198,535			397,070
321	280,000				280,000
371	30,000		30,000	30,000	90,000
465	40,000	40,000		30,000	110,000
517			500,000		500,000
534	300,000				300,000
614		124,000			124,000
682			360,000		360,000
779	380,000				380,000
K-48		640,000			640,000
Total ($K)	1,228,535	1002,535	890,000	60,000	3181,070

Table 2. Leading Institutions in ISTC Projects related to Research Reactors

Leading Organization	Participation in Projects (#)	Number of projects (including funded)	Leading in Project(#)
NIKIET (ENTEK), Moscow	321,465,974,987,988,517	6 (3)	974
NIKIET (Sverdlovsk Branch), Zarechny	987,988	2	987
Nuclear Physics Institute, Gatchina	321	1(1)	321
NIIAR (Atomic Reactors), Dimitrovgrad	858, 534	2(1)	858
Institute of Physics and Power Engineering (IPPE), Obninsk	779,916,974,336,1059,371	6(2)	779,336,916, 371
Kurchatov R.C.,Moscow.	465, 487, 920, 949	4(1)	465,949,920
MEPhI, Moscow	465,534,1079,144	4(3)	144,1079
Institute of Atomic Energy of NNC, Kurchatov, Kazakhstan	K-48, 517,487	3(1)	K-48
VNIINM Bochvar, Moscow	534	1(1)	534
JINR (Joint Institute of Nuclear Research, Dubna	682,974	2(1)	682
Medical Radiological Research (MRRC), Obninsk	336,1059	2	1059
VNIITF, (Chelyabinsk-70)	487, 974, 987, 988	4(0)	487
VNIIEF, Sarov (Arzamas-16)	144,614,682, 1079	4(3)	614
ITEF (ITEP), Moscow	442	1	442

Table 3. Foreign Organizations That Have Confirmed Their Interest in Collaborating on ISTC-Funded Projects Related to Research Reactors.

Financing Parties	Collaborator's Name	Country	Project
European Union	Technische Universität München,	Germany	321
	Centre D'Etudes de Cadarashe, DRN/DER	France	779
	FRAMATOME	France	465,534
	Imperial College of Science, Technology and Medicine/Blackett Laboratory	United Kingdom	465
	Nuclear Liabilities Management Company Ltd.	United Kingdom	465
	Energiewerke Nord GmbH	Germany	K-048
	SGN	France	K-048
	COGEMA	France	371
	Belgonucleaire	Belgium	534,371
	ForschungsZentrum Rossendorf	Germany	144
	European Commission/DG XVII	Belgium	371
	ForschungsZentrum Karlsruhe/ Institute for Transuranium Elements	Germany	371,534
United States	IRPS/C-132 Radiation Physics NIST	United States	465
	Duke University/Medical Center	United States	144
	Lawrence Livermore National Laboratory/University of California	United States	465
Japan	Hokkaido University/ Faculty of Engineering	Japan	682
	Kyoto University/Neutron Science Research Reactor Institute	Japan	682
	Nuclear Safety Commission of Japan		682
	Tohoku University/Faculty of Engineering	Japan	682
	Osaka University/Graduate School of Engineering	Japan	682
	JAERI/Tokai Research Establishment	Japan	517

Table 4. Projects related to Research Reactors

Project No.	Short title	Leading Institute	Requested funding	Approved funding	Funding Party	Comm. date	Duration (months)
	Complex Computer Simulators for Research Reactors						
321	PIK Research and Training Reactor	Nuclear Physics Institute, Gatchina	330 000	280 000	EU	1 Mar 1996	36
858	Computer Complex for Research Reactors	NIIAR (Atomic Reactors), Dimitrovgrad	900 000				36
	Reactor Facility Decommissioning						
465	Radiation Safety during Reactor Decommissioning	Kurchatov R.C., Moscow	178 260	110 000	USA,EU, Sweden	1 Oct 1997	21
779	Dismantling of BR-10 Fast Reactor	FEI(IPPE), Obninsk	380 000	380	EU	1 Apr 1998	24
K-048	Reactor Facility Decommissioning	Institute of Atomic Energy of NNC (2) Kurchatov, Kazakhstan	640 000	640 000	USA	1 Jan 1996	24
	Research Reactors for Examination of Physics and Materials						
371	Pu Utilization in LWR Experiments	FEI (IPPE), Obninsk	875 000	90 000	EU, Japan, Sweden	1 Dec 1996	9
534	Uranium Dioxide Properties	VNIINM Bochvar, Moscow	1 044 800	300 000	EU	1 Apr 1997	24
487	Self-Quenching Pulse Reactor	VNIITF (Chelyabinsk-70)	1150 000				24
614	Nuclear Fuel Behavior	VNIIEF, (Arzamas-16)	124 000	124 000	USA		36
442	Blanket Driven by Accelerator	ITEF (ITEP), Moscow	295 000				30
682	Diagnostics for Neutron Sources	JINR (Joint Institute of Nuclear Research), Dubna	360 000	360 000	Japan	1 Sep 1997	36
517	Skyshine Shielding Experiments	NIKIET(ENTEK), Moscow		500 000	Japan	1 Sep 1996	24
949	Pulse Loads for Fuel Rod Tests	Kurchatov R.C.Moscow	111 640				24
974	Fuel Cladding Lamination	NIKIET (ENTEK), Moscow	674 560				36
987	Irradiation of Austenitic Steel	NIKIET (Sverdlovsk Branch)	501 000				24
988	Reactor Tests for Space Flights	NIKIET (ENTEK), Moscow	486 000				24
	Neutron Sources for Medicine						
144	3D Dosimetry for Radiation Therapy	MEPhI, Moscow	397 000	397 070	EU, USA	1 Oct 1994	36
336	Reactor for Neutron Therapy	FEI(IPPE), Obninsk	650 000				36
1059	Neutron Therapy	Medical Radiological Scientific Center, Obninsk	50 000				9
1079	Optimization of Radiation Therapy	MEPhI, Moscow	642 480				36

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ISTC Projects Related to Research Reactors

Attachment1:

ABSTRACTS

April 1998
ISTC
MOSCOW

Complex Computer Simulators for Research Reactors

#321 Functional Training-Simulating Complex of the Research Reactor PIK (FTSC PIK).

Brief Description

The main purpose of the Project is to develop and build a computer simulator for training and research, built on the framework of a PIK reactor. The simulator will have the simulated workplaces, both for the reactor operators in training and for the instructors. Existing computer codes will be augmented by those developed specifically for this specialized software, so that it can best simulate neutronics and thermophysical and technological processes during transfer regime of research reactors in both normal and emergency states in real-time. slow-time and speed-time modes.

The research reactor PIK is now under construction at the Petersburg Nuclear Physics Institute (Gatchina, near St. Petersburg). The simulator, in conjunction with this research reactor. will be the foundation of a Center for nuclear and reactor study and for training personnel of Russian (and foreign) research reactors. A training center for research reactors does not now exist in Russia.

Leading institution: Nuclear Physics Institute, Gatchina
Supporting institution 1: NIKIET (ENTEK), Moscow
2: NITI, Sosnovy Bor.

Project Manager: Konoplev K. A. (Nuclear Physics Institute, Gatchina)

Tel.(812)-298-8614 Fax: (812)-713-26-13
Approved funds $280,000 (EU) **Duration (months)**: 36

Commencement date: 1 March 1996

Collaborators:
Institute: Technische Universität München, Germany

#858 Multifunctional Computer Complex for Research Reactors

Brief Description

The goal of this project is to develop a training and modeling complex for RRTC (Research Reactors Training Center) in NIIAR (Dimitrovgrad), which will allow up-to-date technical validation of nuclear safety for research reactors to be ensured and support research programs, including elements of uranium-plutonium fuel cycle, and reactor operation modes.

The project includes the following stages:

- collection and processing of the initial data on the BOR-60 (as a pilot option) in order to prepare technical specifications for the simulator software;
- mathematical modeling of the equipment and technological processes;
- development of software and graphic interfaces;
- working-out of a complete set of technical means;
- training and methodical provision (TMP);
- complex debugging and putting into operation.

Leading institution: NIIAR (Atomic Reactors), Dimitrovgrad
Supporting institution: VNIIAES, Moscow

Project Manager: Kalygin V. V, (NIIAR, Dimitrovgrad)

Tel.: (84235)-510-52 Fax: (84235)-356-48
Request Funds: $900,000 **Duration (months)**: 36

Collaborators:

- CORYS,.France;
- SEIMENS, Germany and

- STN ATLAS Elektronik GmbH, Germany.

Reactor Facility Decommissioning

#779 Development of Technology of the BR-10 Reactor Dismantling and Radioactive Wastes Processing before their Utilization.

Brief Description

The project plans to develop a complex of R&D study for technical preparation for the decommissioning of the experimental and test fast-neutron sodium-cooled plutonium-fueled reactor BR-10 (IPPE, Obninsk). The BR-10 reactor should be shut down by the end of 1998.

The project includes the following stages:

- Development of the technical concept of the BR-10's decommissioning.
- Technology of reactor plant dismantling.
- Core reloading scheme.
- Technology of cleaning of primary countour, its components, traps and filters from residuals of radioactive sodium, plutonium, ceasium, mercury, fission products and other radioactive materials.
- Technological methods for reprocessing of radioactive wastes of sodium technology.
- Design of an installation for sodium wastes extermination.

Ecologically acceptable technology for sodium deactivation will be chosen by results of comparison and analysis of developed gaseous, liquid, solid-state processing methods and method of dry burning.

Leading institution: Institute of Physics and Power Engineering (IPPE), Obninsk

Project Manager: Bagdassarov Yu. E., (IPPE, Obninsk)

Tel. (08439) 9-87-13; Fax: (095) 230-23-26

Approved Funds $380,000 (EU) **Duration (months)**: 24

Collaborators: Centre D'Etudes de Cadarashe, DRN/DER, France

#465 The Safety Ensurance at Decommissioning of Reactor Installations of Civil and Military Applications (Monograph)

Brief Description

The project proposers intend to write a monograph summarizing the experience and erudition of the proposers and the original information in the area of decommissioning of stationary (NPP, research reactors) and transport (submarine and icebreeker) nuclear reactors.

The main results of the Project will be:

- Concepts for the decommissioning of nuclear reactors (both transport and stationary types), taking into account their design and economical features.
- Analysis of the elementary compositions of structure, shielding and building of reactor materials that are significant for decommissioning.
- Development and verification of computer codes and updating of data for radioactivity and radiation dose calculations.
- Proposals for requirements and inspection procedures for the analysis of decommissioned reactors.
- Data for radiation contamination of premises, boxes and rooms within the reactor building.
- Analysis of the radiation safety problems important for the population and environment, caused by reusing and/or storage of reactor materials and equipment after the reactors decommissioning.
- Recommendations for the practical minimization of residual activity of reactors under operation.
- Data bank of decommissioned reactors in Russia.

Leading institution: Kurchatov R.C.,Moscow

Supporting institution 1: MEPhI, Moscow

2: Moscow State University of Civil Engineering, Moscow,

3: NIKIET (ENTEK), Moscow

4: Scient. & Res. Center for Nuclear and Radiation Safety of Gosatomnadzor, Moscow

Project Manager: Pologikh B.G., (Kurchatov R.C.,Moscow)

Tel.: (095) 196-73-87; Fax (095)- 196-88-71

E-mail: epv@ITER.coun.msk.su

Collaborators:

- FRAMATOME, France
- Imperial College of Science, Technology and Medicine/Blackett Laboratory, United Kingdom,
- IRPS/C-132 Radiation Physics NIST, United States,
- Lawrence Livermore National Laboratory/University of California United States,
- Nuclear Liabilities Management Company Ltd., United Kingdom

Approved Funds: $110 (USA-40; Sw-30; EU-40)

Commencement date: 1 October 1997 **Duration (months)**: 21

#K-048 The Development of Decommissioning of Operation Technology of the Reactor Facility with Research RA Reactor of the Institute of Atomic Energy of the National Nuclear Center of the Republic of Kazakhstan.

Brief Description

This project led by specialists from Semipalatinsk in Kazakhstan is directed to developing the technology and plan for decommissioning a research reactor at their facility. The plan also provides for temporary storage and eventual shipment of nuclear materials to Russia. The work will give Kazakhstan the technical basis for decommissioning this reactor, as well as some of their other nuclear facilities. The project is based, in part, on approaches and information obtained from the IAEA, and MINATOM in Russia.

Leading institution: Institute of Atomic Energy of NNC (2), Kurchatov Kazakstan

Project Manager: Zelenski D. I., (Institute of Atomic Energy, Kazakstan)

Tel: (322)-226-79-23 Fax: (322)-266-79-23

Collaborators:

- Energiewerke Nord GmbH, Germany,
- SGN, France

Approved Funds: $640,000 (USA)

Commencement date: 1 January 1996 **Duration**: 24

Research Reactors for Examination of Physics and Materials.

#371 Critical Experiments for the Pu- Utilization in LWR Type Reactors Using IPPE Facilities.

Brief Description

The main goal of the Project is to receive the experimental and calculated neutron and reactor data for VVER-type reactors with plutonium content fuel. The critical installations BFS, COBRA, MATR, VENUS and SUPR (the latter under construction now, IPPE) will be used for measurements of such reactor safety parameters as void effect of reactivity, reactivity weights of samples and fuel assemblies, neutron spectrum, reaction rates for both weapon grade and power plutonium content fuel and water as moderator. Comparing of neutron parameters of MOX and UOX fuels, fuel assemblies with various geometry (pins, plate), burning absorbers use - will be done. The Project has received support partly -for the first stage (3 quarters).

Leading institution: FEI (IPPE), Obninsk

Project Manager Kochetkov L. A, (IPPE, Obninsk)

Tel: (08439) 985-87 . Fax: (095) 230-23-26

Collaborators:

- Belgonucleaire, Belgium,
- COGEMA, France, France,
- European Commission/DG XVII, Belgium,
- ForschungsZentrum Karlsruhe, Germany

Approved Funds: $90,000 (EU)

Commencement date: 1 December 1996 **Duration (months):** 9

#442 Shut Down Reactor Transformation into Subcritical Neutron Source. Control and Safety System Substantiation and Development

Brief Description

The main goal of the Project is to develop and to construct the large scale prototype of a subcritical system, consisting of a linac-driven target and a subcritical blanket, and to research its neutron and physical parameters, safety of the operating regimes - as the beginning stage of concept study.

The second goal of the Project is to develop an R&D study, a technical design and to fabricate the mock-up of the control and safety system for SNS (Subcritical Neutron Sourse) as a part of SNS project.

The main results of the Project will be:

- the optimal choice of a subcriticality margin for safety operation of the SNS and the mock-up.
- the ranges of the parameters and the transfer regimes for various operational modes of the subcritical facility,
- tested control and safety system concept,
- software,
- results of experiments and tests, and
- working prototype and mock-up of SNS .

Leading institution: ITEF (ITEP), Moscow
Supporting institution: 1. State Enterprise Krasnaya Zvesda, Moscow
2: VNIITF, Snezhinsk (Chelyabinsk-70

Project Manager: Vasiliev V. V, (ITEF (ITEP), Moscow)
Tel: (095) 127-05-43, Fax: (095) 123-65-84

Requested funds $295,000 **Duration (months)**: 30

 # 682 The Creation of Diagnostic Systems for Pulsed Neutron Sources

Brief Description

The project aims to develop the following systems for the IBR-2 pulse reactor, located at the leading institute - JINR, Dubna :

1) diagnostic system for reactor parameters;
2) diagnostic system for mechanical vibration; and
3) measurement system for power pulse parameters.

During the implementation of the project the technology, used for diagnostic and monitoring , will be refined; this will allow the project results to be applied to other pulse neutron sources.

Leading institution: JINR (Joint Institute of Nuclear Research, Dubna
Supporting institution 1: VNIIEF, Sarov (Arzamas-16)

Project Manager: Pepyolyshev Yu. V., (JINR, Dubna)
Tel: (095)-926-22-31 Fax: (096)- 216-50-85

Collaborators:

- Hokkaido University/ Faculty of Engineering, Japan,
- Kyoto University/Neutron Science Research Reactor Institute, Japan,
- Kyoto University/Research Reactor Institute, Japan,
- Nuclear Safety Commission of Japan, Japan,
- Osaka University/Graduate School of Engineering, Japan,
- Tohoku University/Faculty of Engineering, Japan

Approved Funds $360,000 (Japan)
Commencement date: 1 September 1997 **Duration (months)**: 36

#534 Complex Investigation of Advanced Uranium Dioxide and Mixed Uranium-Plutonium Dioxide Fuel's Properties for Prediction of Performance and Operating Characteristics and Verification of Calculation Models of Fuel Elements for Operative and Advanced Atomic Stations Power Reactors

Brief Description

The main goals of the joint project proposal by the Russian and Kazakh institutions are to develop new research methods and to complete an experimental and theoretical study of advanced uranium dioxide and uranium-plutonium dioxide fuels with attractive economical and technical features.

The main results of the Project will be:

- new methods for experimental study and scientific prognoses of working and life-time characteristics of LWR (VVER-type) fuel elements irradiated up to high-level burnup;
- a set of mechanical, structural and composition data for advanced and conventional irradiated VVER-type fuel (burnup above 40 MW-d/kg(U));
- data for high-temperature superheat regime effects on the physical, mechanical and structural features of the VVER-type fuel;
- verified models and computer codes;
- recommendations for improvement of LWR reactor safety and economy.

Unique experimental installations for continuous on-site analysis of fuel and fuel element features during irradiation within the research reactor under various workload conditions, as well as ones for after-exposure studies and specimen production, will be developed, modernizied and utilized in Dimitrovgrad (NIIAR), Kazakhstan (ULBA) and Moscow (VNIINM and MEPhI). These installations previously were used mainly for military applications.

Leading institution: VNIINM Bochvar, Moscow
Supporting institution 1: NIIAR (Atomic Reactors), Dimitrovgrad, Russia
2: MEPhI, Moscow, Russia
3: State Holding Company ,"Ulba"Ust Kamenogorsk, Kazakstan

Project Manager: Evstyukhin N. A. , (MEPhI, Moscow)

Tel: (095) 323-93-06, Fax: (095) 324-21-11

Collaborators:

- Belgonucleaire , Belgium,
- ForschungsZentrum Karlsruhe/Institute for Transuranium Elements, Germany,
- FRAMATOME, France

Approved Funds: $300,000 (EU)
Commencement date: 1 April 1997 **Duration (months):** 24

 # 0614 Numerical Simulation of Nuclear Fuel Behavior during Accidents and Normal Operation

Brief Description

To improve reactor safety the project plans to develop and to verify new methods and computer codes for better understanding of thermal and mechanical processes within the components of reactor fuel elements and primary coolant circuit of power nuclear reactors during both regular and emergency transients.

The project results would advance the modern reactor thermo-hydrolical codes (ATLET, TRAC and so forth) if the developed models of phase transition and thermal expansion processes will be included into the codes' skeleton (they are not yet included now).

Methods and approaches to be devised can be applied for analysis of the Western PWRs.

The project consists of the following parts:

- Development and upgrading of computer codes TVEL (description of all stages of fuel element states - from normal operating mode till complete failure) and RATEG (two-phases coolant flow with essential temperature and velocity spatial irregularity).
- Verification of developed codes with using of VNIIEF experimental data (reactor in-pile experiments with failures of fuel elements).
- Unification of codes for their compatibility with international codes.

Leading institution: VNIIEF, Sarov (Arzamas-16)

Project Manager: Ustinenko (V A, VNIIEF, Sarov (Arzamas-16))

Collaborators:

- GRS Gesellschaft fur Anlagen und Reaktorsicherheit mbH , Germany

Approved Funds $124,000 **Duration (months)**: 36

#517 Experimental Studies of Reactor Radiation Scattering in the Atmosphere.
Brief Description:
The main goal of the project is to ensure radiative safety of population living close nuclear installations - NPPs, nuclear fuel fabrication and refabrication plants; the project will be carried out on the basis of experiments and computations. The expected results are:
- analitical, computering preparation and optimization of experimental program;
- preparation of RR reactor acting and validity of its safety;
- preparation and development of measurement technique;
- carring out of reactor settings;
- processing of experimental results.

The Poject will help the Russian (ENTEK) and Kazakh (Atomic Energy Institute) reactor institutions to develop mutual their cooperation as well as to establish partnership with foreign collaborators.

Leading institution: NIKIET (ENTEK), Moscow
Supporting institution: 1: Institute of Atomic Energy of NNC (2), Kurchatov, Kazakstan

Project Manager: Netecha M. E, (NIKIET (ENTEK), Moscow)
Tel: (095)-264-40-10 Fax: (095) 975-20-19

Collaborators:
- JAERI/Tokai Research Establishment, Japan

Approved Funds: $500,000 (Japan)
Commencement date: 1 September 1996 **Duration (months)**: 24

#949 The Nuclear-Thermal Method of Pulse Loads for Fuel Rod Tests to Ensure the Nuclear Power Reactor Safety

Brief Description
The purpose of the Project is to develop a nuclear-thermal method of pulse dynamic on the loads for fuel rods tests on the basis of research nuclear reactors and to apply it for the development and testing of the design and materials composite of the fuel rods from the point of view of ensuring the reliable reactor core operation.

Project plans to develop and test the methodology and to conduct experiments at HYDRA and ARGUS research reactors; and for the integration of experimental data, to develop corresponding numerical codes. The experimental data base as a result of the project implementation and data integration on the basis of calculation and theoretical models will allow to formulate recommendations on the development of the optimum, from the safety point of view, designs, material, compositions of fuel rods, in particular, data will be obtain, that allow to predict radioactive product releases and their distribution in the environment.

Leading institution: Kurchatov R.C., Moscow
Supporting institution: TRINITI, Troitsk, Moscow region

Project Manager: Chechurov A M., (Kurchatov R.C., Moscow)
Tel: (095) 196- 90-54, Fax: (095) 196- 66-39

Requested funds $111,64 **Duration (months)**: 24

#974 The Effect of the Fuel Cladding Lamination in Nuclear Power Reactors Under Emergency Situations

Brief Description

The Project proposed is devoted to the study of the mechanism, realization conditions and the possibility of suppressing the lamination effect of a fuel cladding made of Zr-based alloys which develops under the situations of emergency temperature rise in the existence of the fracture of the fuel pin (a free volume between fuel pellets). The following results will be obtained:

- determine linear dimensions of the intrafuel cavity as function of helium density, neutron spectrum and dose at which the accumulation process in the near layers of the cladding reaches the values sufficient to develop lamination in emergency regimes;
- study the mechanism and the oxygen-temperature regimes of transporting the accumulated helium into the inner layers of the claddings and the development of gas-bubble porosity and lamination;
- make recommendations for suppressing the effect considered.

Leading institution: NIKIET (ENTEK), Moscow
Supporting institution 1: JINR (Joint Institute of Nuclear Research), Dubna,
2: FEI (IPPE), Obninsk
3: VNIITF, Snezhinsk (Chelyabinsk-70),

Project Manager: Subbotin A. V., (NIKIET , Moscow)

Tel:(095)-268-93-90 Fax: (095)-975-20-19

Requested funds $674,56 **Duration (months):** 36

#987 Investigation of the Influence of Low-temperature Irradiation on Austenitic Steels and Prediction Method Development of its Physical and Mechanical Properties

Brief Description

The objectives of this project are to develop:

- Experimental data base on the influence of neutron irradiation on the physical and mechanical properties of austenitic steels at IVV-80K in IVV-2m reactors;
- Computer simulation code of low temperature defect formation process in austenitic steels under cryogenic neutron irradiation;
- Formation and evaluation model of low temperature radiation defects and their influence on physical and mechanical properties of austenitic steels.

Leading institution: NIKIET (Sverdlovsk Branch, Zarechny)
Supporting institution: 1: Ural State Technical University, Ekaterinburg
2: NIKIET (ENTEK), Moscow
3: VNIITF, Snezhinsk (Chelyabinsk-70)

Project Manager: Sinelnikov L P.,(NIKIET, Sverdlovsk Branch)
Tel: (34377)- 312-05 Fax: (34377)-333-96

Requested funds $501,000 **Duration (months):** 24

#988 Reactor Tests in Hydrogen Medium and Post-Reactor investigations of Material Properties of Nuclear Power-Plant for Space Flights

Brief Description

The project aims at the creation of a reliable and safe nuclear thermal power propulsion (NTPP) system for piloting flights to Mars and other objects of the solar system. The materials of the space nuclear power plant will be in operation under specified conditions of the simultaneous effects of high temperature, irradiation, and hydrogen. Certain properties of these materials are provided during the implementation of reactor tests in a hydrogen medium in a temperature range of 60-2500°C. The mechanical and physical characteristics, as well as the composition and microstructure of these materials, will be determined in post-reactor investigations. The final result of the project will be a research report and recommendations for industry on types of material fabrication.

Leading institution: NIKIET (ENTEK), Moscow
Supporting institution: 1: VNIITF, Snezhinsk (Chelyabinsk-70)
2: NIKIET (Sverdlovsk Branch), Zarechny

Project Manager: Smetannikov V P., (NIKIET, Moscow)
Tel: (095)-267-34-97 Fax: (095)-975-20-19

Collaborators:

- Aerojet, USA
- CEA/DMT , France

Requested Funds: $ 486,000 **Duration (months):** 24

Neutron Sources for Medicine

#144 Development of a three-dimensional dosimetry planing system for radiation therapy.

Brief Description

The purpose of this project is to develop a new, fast, and accurate method of dosimetry planning for radiation therapy of tumours. The research will include full-scale three-dimensional simulation of the treatment planning system using Monte-Carlo methods to be analysed on a work station. This project should provide Russia with better means to treat cancer and should also offer opportunities to improve current foreign cancer treatment techniques. Dose field analysers currently available from foreign suppliers are prohibitively expensive and are not as fast or accurate as the analyser envisioned to be developed on the basis of this project.

Leading institution: : MEPhI, Moscow
Supporting institution: 1: Cancer Research Center, Moscow
2: VNIIEF, Sarov (Arzamas-16)

Project Manager: Klimanov V A, (MEPhI, Moscow)
Tel. : (095) 324-31-74 , Fax : (095) 324-21-11

E-mail : klimanov@radian.mephi.msk.su

Collaborators:

- Duke University/Medical Center, United States,
- ForschungsZentrum Rossendorf, Germany.

Approved Funds: $ 397,07 **Duration (months):** 36
Commencement date: 1 October 1994

#336 Research on improvement of methods and means for neutron therapy.
Brief Description
The main purpose is to obtain experimental and calculated data for improvement methods and means of neutron therapy and to make a concept elaboration for a future irradiation unit with a small-size reactor, to create the effective advanced neutron therapy treatment methodology.
The project includes the following stages:

- Creation of an experimental facility on basis of the reactor-source (PC-2) and carrying out the experiments for substantiation of the characteristics of the fast and thermal neutron beams, neutron filter materials, beam collimators, biological shielding and the dose field inside of the treatment room.
- Caring out neutron, thermal and other calculations concerning the experimental work and concept elaboration of the irradiation unit.
- The radiation therapy methodology improvement on the basis of experience obtained for last years and on the basis of planing clinical researches.

Leading institution: Institute of Physics and Power Engeneering (IPPE), Obninsk
Supporting institution 1: Medical Radiology Science Center, Obninsk
Project Manager: Ernest E. Petrov, (IPPE, Obninsk)
Tel: (08439) 9-85-83 Fax: (095)230-23-26

Requested Funds: $ 650,000 **Duration (months) :** 36

#1059 Feasibility Study for the Creation of a Neutron Therapy Center on the Basis of Nuclear Reactors
Brief Description
The goals of this project are to prepare the complete set of scientific, technological, economic and other documentation for feasibility study of development of the concept for a typical Neutron Therapy Center (NTC). The experience of this Center, established in Obninsk can serve as a pilot for other such institutes in Moscow, Ural, St.Petersburg and other region. The project is based on long-time practical experience of Medical Radiological Research Center and Institute of Physics and Power Engineering where BR-10 reactor is using for radiation therapy.
The project plan consists of the following parts:

- to create information database "Neutrons in biology and medicine", including Russian and international information;
- to carry out the risk analysis and the necessary marketing researches;
- to organize working coordination meetings of the experts on the problem;
- to establish collaboration with the CIS and international physics and medical organizations;
- to prepare the project to the ISTC covered the complex problem.

Leading institution: Medical Radiological Research (MRRC), Obninsk
Supporting institution 1: IPPE, Obninsk
2. - SSC RF Institute of Physical Chemistry (IPC) Obninsk branch
Project Manager: Stepan E.Oulianenko, (MRRC), Obninsk
Tel: w. (08439) 7-47-51, h. (08439) 7-79-41
Fax: (095) 956-14-40 E.mail: mrrc@obninsk.ru

- **Collaborators:**
- Massachusette Inst. of Tech. Nuclear Reactor Laboratory, USA
- University of Bremen, Department of Chemistry ,Germany
- Harper Hospital, Detroit Medical Center, USA

Requested Funds: $ 50,000 **Duration (months):** 9

#1079 System for Optimization of Radiation Therapy Planning by Photon and Electron Beams on the Basis of a Pencil Beam Algorithm.

Brief Description

The project plans to elaborate a computer system for dosimetry planning of radiation treatment, which will allow a considerable increase in the efficiency and quality of cancer patient treatment. The new project is a logical continuation of the previous one (# 144-94, ending 30.09.1997), which has developed a new system for 3-D dosimetry planning and a promising modification of the Monte Carlo method for fast and accurate prediction of volume distribution of exposure doses.

The project includes the following stages:

- elaboration of an algorithm and computer code for 3D calculation and dose optimization on the basis of a large-scale elements method and a pencil beam algorithm;
- selection and investigation of appropriate physical and radiobiological objective functions;
- creation of an automated installation for manufacturing molds to cast shielding blocks and compensating filters to form the optimum profile of the incident beam;
- development of an effective code for calculating the dose volume distribution on the basis of the Monte Carlo method with PL-estimators;
- creation of an experimental installation and verification of the results of optimization;
- elaboration of a Quality Guarantee Program for the realization of an optimum irradiation plan.
- It is also assumed that clinical tests of developed system (Cancer Scientific Center, Moscow) will be carried out within the framework of the project.

Leading institution: MEPhI, Moscow.

Supporting institution: 1.RFC VNIIEF, Sarov.

2.Cancer Research Center of RAMS Scientific Research Institute of Clinical Oncology (NIICO), Moscow.

Project Manager: Klimanov V. A, (MEPhI, Moscow)

Tel.: : (095) 324-31-74 , Fax: (095) 324-21-11

E-mail: klimanov@radian.mephi.msk.su

- **Collaborators:**
- Karolinska Institute, Stockholm University, Sweden;
- Institut für Sicherheitsforschung, Forschungszentrum Rossendorf, Germany;
- Institute for Protection and Nuclear Safety, France;
- University of Wisconsin-Madison Medical School, USA and
- Washington University School of Medicine, Dr. A. Purdy, USA.

Requested Funds: $ 642,480 **Duration (months) :** 36

Medical Radioisotope Production by Research Reactors

#916 Development of Production Technologies of High Pure Radioactive Isotopes for Medical and Biological Application on the Base of the Fast Neutron Research Reactor. Brief Description

The main purpose of this project to develop and test a fast reactor-based production technology of high pure P-33, P-32, S-35, Sr-89, and Sn-117m radioisotopes for medical and biological application. The project creates a scientific and technical base for production of these radioisotopes and labeled compounds dedicated to diagnostics, therapy and scientific research in Russia and other countries using the radiochemical complex available in the SSC-RF-IPPE as a base. Newly developed radiopharmaceuticals based on Sn-117m have no analogues worldwide. The Sr-89-based radiopharmaceuticals have high specific activity and radionuclide purity levels which cannot be achieved using the existing technologies of Sr-89 production.

The project consists of the following steps:

- Theoretical and experimental research or a process for highly pure isotopes production in the core of the BR-10 reactor
- Development of irradiating targets design and development of process and quality control methods.
- Production of test batches of the radionuclides
- Certification of the isotope products in accordance with the Russian state standard system (GOST-R).
- Production of reference batches of the products.

Leading institution: IPPE, Obninsk

Project Manager: Skoblov Yu. S, (IPPE, Obninsk)

Tel:(08439)-987-89 Fax: (08439)-480-08

- **Collaborators:**
- International Isotopes Clearing House Inc., USA,
- Isotopchim, France,
- Bio-Nucleonics Inc., USA.

Requested Funds: $ 250,000- **Duration (months) :** 24

#920 Development of High-Effective and Low-Waste Technology of Fission-Fragment 99 Mo Production for Medical Purpose Based on Use of Fluoride Molten Salts

Brief Description

The project plans to develop a new technology for Mo-99 production for medical applications, combining high efficiency and low accompanying radioactive waste due to the use of a mechanism for isotope extraction in the form of aerosol or fluorides from a gas over a molten salt in a fission reactor.

The project consists of the following stages:

- Research of physicochemical aspects of fission-fragment molybdenum behavior in molten salt fluorides. Determination of its solubility in molten salt of various composition, studying its chemical form and rate of removal from fuel composition and deposition on a structural materials surface.
- Research of vapor phase by IR-spectroscopic methods over the molten salt for determination of the molecular structure of fluorides and aerosols.
- Calculational study on development of specialized molten salt nuclear installation concept for industrial ^{99}Mo production using the proposed technology.
- Technological experiments in a research reactor for demonstration of the efficiency of the proposed ^{99}Mo production method.

Leading institution: Kurchatov R.C. Moscow:

Project Manager: Chuvilin D. Yu., (Kurchatov R.C, Moscow)

Tel: (095)-196-75-80 Fax: (095)-194-19-94

- **Collaborators:**
- Centre d'Etude de L'Energie Nucleaire SCK-CEN, Belgium,
- Institute of Radio-Elements IRE, Belgium,
- European Association for Nuclear Proliferation Reduction and Third World Development by Molten Salt Reactors Deployment EURIWA France,
- NUKEM GmbH, Germany,
- Brookhaven National Laboratory, USA.

Requested Funds: $ 234,920 **Duration (months):** 24