ANNEX I

Work Plan

I. Summary Project Information

1. Project Title

Scale experimental investigation of the thermal and structural integrity of the VVER pressure vessel Lower Head in severe accident

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3. Participating Institutions

3.1. Leading Institution

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3.2. Other Participating Institutions

Participant Institution 1

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Participant Institution 2

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4.2. Partners

None

5. Project Duration

36 months

6. Project Location and Equipment

Institution	Location, Facilities and Equipment
Leading Institution	The experimental test facility and experimental investigations on the heating, mechanical behaviour and failure of the VVER vessel scale models will be carried out at the test cell #5 located in building of the MPEI thermal power plant. Some of the research experimental equipment and installations were placed on that area before, and it are dismantled now. The test cell #5 requires reconstruction and repair for the future experimental equipment's placement and for carrying out the scale experiments. Experimental test facility to be built will incorporate the experimental protective box, heating system, control and data acquisition system (DAS), ancillary equipment and systems (gas, water, electricity systems etc.). The working space of the test installation will consist of the scale model (mock up) of the VVER reactor pressure vessel (RPV) lower head (LH), heater, cooling system, measurement sensors and devices (temperature, displacement, pressure), support systems' armature (gas, water and electricity etc.). Additional transformers, as well as control devices for them need to be mounted for the electric heating system; also the special model's heater and supporting cooler devices need to be built for that purpose. It is necessary to create or to purchase appropriate DAS and control system. Scale VVER LH models must be fabricated from the 15Kh2NMFA vessel steel according to the regular treatment technology used for the VVER reactor pressure vessel fabrication. Administrative rooms in the "T" building of MPEI (rooms #307 and 308) will be used for analytical works and project's management within the project. It is necessary to purchase supplementary computers and software for carrying out the numerical simulations and analytical works. It is essential to provide for office equipment (fax, Xerox, slide projector etc.) and for communication service too. Also it is necessary to reconstruct and to repair the experimental space (cell #5) in the MPEI thermal power plant building as well as the administrative area (rooms #307 and 308) in the "T" building. It is planned, the numerical simulations on the heating and mechanical behaviour of the VVER scale models (pre- and post-tests calculations) will be carried out by means of domestic computer codes ATM-VVR and NARAL/ FEM, and by commercial code ANSYS also.
Participant Institution 1	Work within the project will be carried out in rooms #309, 601, 608 of the administrative building. Numerical calculations on the assessment and choosing of the severe accident's scenarios in the VVER-440 will be accomplished by means of the RELAP/SCDAP and MELCOR codes. Numeric simulations of the heating and structural analysis of the VVER LH models (pre- and post-tests calculations) will be provided by means of the domestic thermomechanical codes and commercial code MSC.Marc..
Participant Institution 2	It is planned the rooms of the main administrative building IGiL (rooms #122, 229 and 340) will be used as well as experimental areas of the IGiL static strength lab for the purpose to work during the project. It is necessary to repair rooms #122, 229, 340 and the areas of the static

	strength lab too. The high-temperature creep tests will be carried out on the test equipment and machines of the own projects as well as on the Zwick/Roell, Instron test machines (with furnace). It is essential to modernize the test equipment and heating furnaces for carrying out the high-temperature material property testing of the VVER vessel steel (modernization of the control systems and test machines loading, and also of the heating furnaces and gas system). It is necessary to purchase additional computers and software as well as office equipment (fax, Xerox, slide projectors etc) and communication service devices.

II. Specific information

1. Introduction and Overview

Present project is associated with the peaceful uses of atomic energy and it is aimed on the considerable enhancement safety of the nuclear power plants with the VVER-440 reactors due to the unique experimental findings on the heating, structural behaviour and rupture of the VVER-440 vessel scale models in the severe accident (SA) conditions. The safety assessment of the operating and new generation reactors is based on the computer simulation of the SA phenomena by means of the numerical SA codes. The verification and validation of them against the corresponding experimental data is the indispensable condition for such work.

It is known, that exists a possibility of the melt relocation and accumulation on the lower head (LH) of the reactor vessel during SA with core meltdown in the vessel-type reactors (VVER, LWR, PWR). In that case the vessel plays the role of the main barrier to prevent the radioactive materials release to environment. Furthermore, a model of the vessel deformation and failure has determinative influence on the course of the SA next stages. That's why the analysis of the reactor's vessel integrity during SA with partial or total core meltdown is the key moment in the overall safety analysis of the reactor installation. Interaction of the corium and vessel steel during the similar accidents is a very complicated process accompanied by heating and melting of the vessel wall, its deformation, as well as by formation of the low-melting eutectics. Beside that, heating of the vessel steel to more than 500 C leads to the essential decreasing of its strength properties. Analysis of the native and foreign investigations on the vessel behaviour and failure during SA revealed the high-temperature creep of the vessel steel is the main cause of the vessel deformation and failure.

The analysis of the well-known accident on the Three Mile Island NPP in USA (TMI-2, March 28, 1979) showed that the relocation more than 20 tons of the melting core fragments to RPV lower head led to its intensive heating (more than 700 C) and vessel deformation. Further analysis of that accident proved the urgency of the deep analytical and experimental investigations aimed on the study of the creep and failure conditions of the LH RPV during SA in the safety assessment of the operating and new generation NPP [1,2]. So, the safety substantiation of new generation reactor EPR (French-German European Pressurized Water Reactor)– Olkiluoto-3 in Finland, has been based on the wide range international cooperation in the network of the European programs (4-th and 5-th framework programs of the EU) and OECD [3-4].

Comprehensive analytical and experimental studies of several aspects (heating, structural integrity etc) of the reactors vessel behaviour in SA were the principal item of well-known international research programs and projects [5-9], in particular, VIP (OECD), LHF and OLHF Projects (Sandia Lab., USA), CORVIS-PSI (Paul Sherrer Institute, Switzerland), FOREVER-experiments (the Royal Institute of Technology, Sweden), ARVI Project (Assessment of Reactor Vessel Integrity), the EUROCORE concerted action (European Group for analysis of Corium REcovery concepts), MOSES Project etc. Experimental results received in the course of those investigations, are very important from the view-point of the validation and verification of the SA computer codes and mathematical models of the studied phenomena (creep, failure of the vessel steel etc).

The main tasks of the foregoing investigating programs, concerned with the heating, deformation and failure of the reactor vessel included, as a rule, the follows:

a) experimental investigation of the heat up, creep deformation and failure of the scale reactor vessel models. Scale vessel models (with max geometrical scale up to ~1:5) were manufactured from the original reactor vessel steels. In the course of the experiments the temperature state was registered, and also time, creep deformation and failure of the vessel models were recorded. The heating of the studied vessel models run up to more than 600 C by means of the special heaters. In particular, in LHF/OLHF experiments the vessel models heated through the induction heater, and in the FOREVER and CORVIS experiments the heating of the vessel models was achieved by the liquid molten pool, heated by special electric heater. Never before similar combined experimental and analytical works on VVER vessel, concerned with investigation of its heating, creep and failure in the SA were done in Russia;

b) material property tests to determine the constitutive creep models and ordinary mechanical characteristics of various western reactor vessel steels. The main objective of these tests was to receive input data for development of adequate creep models of each of tested steels. The creep models were implemented in the structural mechanical codes for numerical simulation of the creep behaviour of the western type RPV during SA;

c) the verification of the mathematical models both as the structural thermo-mechanical codes against data received in the course of the RPV scale tests.

The overall objective of this project is the experimental and numerical study of the VVER LH reactor vessel scale models within transient thermal and its overpressure loading which correspond to realistic SA scenarios accompanied by the high-temperature heating, creep deformation of the reactor vessel. In this context the project efforts are focused on the following problems:

1) the designing and construction of the test facility for test examinations of the VVER vessel scale models (up to ~1:5) on the conditions which correspond to SA in VVER. Experimental facility to be built includes: working space, scale model and its heater, control and experimental information gathering system (DAS), support systems (gas, water systems, video monitoring devices etc.);

2) manufacturing of the VVER LH reactor vessel scale models. Material and technology, as well as thermal treatment have to correspond the same conditions of the regular VVER vessels manufacturing;

3) pursuance of the material creep test experiments with samples from the VVER vessel steel on the time range 2-50 hours and temperature range 600 - 1200 C to receive the creep data for refinement of the constitutive creep model and ordinary mechanical characteristics of this steel;

4) the carrying out the scale experiments with VVER vessel models on the high-temperature heat-up and creep deformation of the vessel;

5) the mathematical treatment and analysis of scale experiments, carrying out the numerical pre- and post-test structural analyses of scale experiments with vessel models by means of domestic code ATM-VVR and also by commercial codes MSC.Marc, MELCOR, RELAP/SCDAP for validation of the mathematical models implemented in these codes.

The necessity of suggested project is determined by:

a) a lack of the experimental data on the VVER-440 vessel deformation and failure because of the high-temperature creep phenomenon of the vessel steel. These experimental data are necessary to straighten out the real behaviour of the VVER vessel during SA, as well as for the verification of the computer SA codes (domestic and foreign). The given results will allow more adequately estimate the influence of the associated processes (the vessel creep effect, thermal and mechanical loads etc.) on a lifetime and behaviour of VVER vessel;

b) achievement of the project's tasks will permit to reduce noticeably the conservatism of the numerical simulations associated with VVER safety, and also to elaborate and to carry out all necessary actions for SA management strategy;

c) the material property creep tests of the 15Kh2NMFA vessel steel samples shall permit to define more precisely and to complete available data on its creep and failure, and to clarify the constitutive creep model and ordinary mechanical characteristics of this steel also.

For more than 10 years the NPP Department staff (MPEI-TU) carried out the complex of research works in the network with the enterprises of Russian Federal Atomic Energy Agency concerned with thermal physical aspects of the SA events in the NPP. The special computer codes were developed for numerical simulation of studied phenomena within above mention investigations, in particular, the ASHTER-VVER and ATM-VVR codes [10-12] for structural analysis of the VVER RPV, as well as the NARAL and NARAL/FEM codes for numerical simulation of the molten pool behaviour. The numerical analyses of the VVER-440 vessel behaviour during SA with molten pool formation were carried out by means of these codes. The previous version of the program (ASHTER-VVER) was used for the high-temperature creep and failure simulations of the VVER-640 and VVER-1000 vessels during the design-basis and beyond the design-basis accidents [10-12].

For the purpose of carrying out the tasks of the present project, it is supposed to use the ATM-VVR as the main computer code for pre- and post-test thermomechanical analyses of the VVER vessel scale models . Creep model, implemented in this program, gives the possibility to simulate the vessel steel creep until its failure, which permits to combine the stress-strain state and failure problems. Ideology of using similar approach for the high temperature creep modeling of the RBMK fuel channel pressure tubes was fulfilled earlier in the ATM-TK (ASHTER-TK) computer code [13-14]. Members of the MPEI team also have essential experience in the preparatory work and carrying out the high-temperature testing [15-17]. In particular, in the course of the RBMK PT models testing the unique heaters were produced, that gave the possibility to reproduce the accident-heating conditions during beyond the design-basis accidents in RBMK.

The Static Strength laboratory of Lavrentyev Institute of Hydrodynamics ("IGiL") of the Siberian Branch of the Russian Academy of Sciences (SO RAN) is one of the oldest labs in Russia, which are working in the field of high-temperature testing of the metals and metal alloys. During the last five years lab staff received fundamentally important results on the high temperature creep of the VVER vessel steel [18]. Some of group's investigations are concerned with construction of the adequate creep models of testing materials, as well as with high-temperature testing of the machine-building fragments [19-21].

Experimental and Design Organization "GIDROPRESS" (EDO "GP") as a work co-executor is the representative of the organization, that is the head designer of the VVER reactors. The primary task of this team is the analysis and choosing the

SA scenarios and testing conditions of the scale experiments with VVER vessel models and interpretation of the experimental results. Members of this team are highly skilled and have a long-term experience of the carrying out the design-analytical works on the SA for the VVER-440, VVER-1000 by means of BISTRO, RATEG/SVECHA/GEFEST, MSC.Marc, MELCOR and RELAP/SCDAP [22-27] .codes

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2. Expected Results and Their Application

In the course of fulfillment of the given project it is supposed to receive the following results:

1) experimental data on the creep behaviour, heat up and failure of the VVER-440 vessel scale models that will enlarge the current knowledge about the VVER behaviour and the essence of the governing thermal and creep processes during this SA stage;

2) experimental data received in the course of the VVER vessel model tests will be used as a basis for verification of the thermo-mechanical numerical codes (native and western commercial), which are used in the safety assessment in SA and SA management strategy for NPPs with vessel type reactors;

3) the material property creep test results of the 15Kh2NMFA vessel steel samples will permit to obtain an additional material property of the VVER vessel steel in the range of 600 to 1200 C and failure times from 2 to 50 hours. Also these data will be used as a basic to define more precisely and to complete available data on creep and failure, and also to clarify the constitutive creep model of this steel;

4) data of the VVER-440 vessel scale model tests will give the possibility to perform preliminary comparison of the computing possibilities of the numerical thermo-mechanical codes.

2.1. Sustainability Implementation Plan

2.1.1. Results to be promoted

- experimental data on the tests of the VVER lower head scale models within its heat up, creep deformation and failure on the conditions which correspond to realistic accident scenarios in VVER-440;

- material property creep and failure data of the 15Kh2NMFA vessel steel in temperature range from 600 to 1200 C and test time from 2 to 50 hours.

2.1.2. Uniqueness of results

The uniqueness of the project's results is proved by lack of the experimental data on the VVER-440 vessel deformation and failure during SA, which are very important for understanding of the governing creep and thermal processes in the VVER RPV during SA, as well as for verification of the computer SA codes used for the safety assessment of the NPPs with vessel type reactors (VVER, PWR, LWR).

2.1.3. Demand for results

Potential consumers of the project's results are the development and design organizations of Russia working on the design and safety assessment of the NPP with VVERs. In particular, one of them is FDO "GIDROPRESS", the Head designer of the VVER reactors and one of the project participants.

2.1.4. Expected income

Profit on the project results will be determined first of all by the created infrastructure (experimental facility, control system and DAS etc), which can be used for carrying out next high thermal tests of the reactor components.

2.1.5. IPR situation

Scientific ideas and new design-technological solutions, received during the present project, will be protected due to patenting.

2.1.6. Additional developments

Now a lot of the domestic both as foreign organization need the results of this project. This is proved by participation of the leading Russian teams (FDO "GP" etc.) and foreign collaborators in this project.

2.1.7. Plan of implementation

Profit draft of the project is not worked out by now.

2.1.8. Additional licenses or permits

The project results realization may demand additional permissions and licenses of the corresponding organizations, supervising the nuclear power installations in Russia, and also high-pressure utilities (similar to the former "Kotlonadzor").

2.1.9. Business network

The project results realization supposes the participation of the development and design organizations of Russia working on the design and safety assessment of the NPP with VVER, as well as Russian Atomic Energy Agency support.

3. Meeting ISTC Goals and Objectives

Suggested project completely meets the basic principles and purposes of the ISTC and will permit especially:

1) to redirect the gifts and experience of Russian weapons scientists to peaceful activity;

2) to integrate Russian weapons scientists into the international scientific community;

3) to contribute to the nuclear safety strengthening of current and new generation NPPs with VVER.

4. Scope of Activities

The work in the course of this project might be presented in the form of several interrelated tasks and, which in their turn consist of the subtasks series. Below, MPEI, GP, and IGiL denote the participant groups of Moscow Power Engineering institute (MPEI), Federal Experimental and Design Organization "GIDROPRESS" (EDO "GP") and Lavrentyev Institute of Hydrodynamics of the Siberian Branch of the Russian Academy of Sciences.

Task 1

<table>
<tr><th colspan="2">Task description and main milestones</th><th>Participating Institutions</th></tr>
<tr><td colspan="2">Task “A”: analytical studies that include: the choosing of the accident scenarios and test conditions of the scale experiments; carrying out of the pre- and post-tests of the scale experiments; final R&D report issue</td><td>1-“MPEI”
2-EDO “GP”
3-</td></tr>
<tr><th colspan="3">Description of deliverables</th></tr>
<tr><td>1</td><td colspan="2">SA scenarios and SA conditions will be reproduced during the scale experiments with VVER vessel models</td></tr>
<tr><td>2</td><td colspan="2">Expected thermal and deformation behaviour of the vessel models (as a result of the pre-test calculations) during the scale tests, and the post-test calculation results of the performed experiments on the VVER vessel scale models</td></tr>
<tr><td>3</td><td colspan="2">The intermediate reports on the choice of the accident scenarios and conditions of the scale experiments. The final R&D report issue. The articles on the tests results and post-test calculations of the performed experiments</td></tr>
</table>

Task 2

<table>
<tr><th colspan="2">Task description and main milestones</th><th>Participating Institutions</th></tr>
<tr><td colspan="2">Task “B”: development and manufacturing of the experimental test facility and supporting systems for the VVER scale vessel models testing</td><td>1-“MPEI”
2-
3-</td></tr>
<tr><th colspan="3">Description of deliverables</th></tr>
<tr><td>1</td><td colspan="2">The operation factors and main requirements of the experimental test facility and supporting systems. Technical project and design documentation for development of the experimental installation, test space and supporting systems. Produced experimental test facility and its components</td></tr>
<tr><td>2</td><td colspan="2">Technical project and design documentation for the VVER vessel models manufacturing. Produced VVER vessel models (4 pieces)</td></tr>
<tr><td>3</td><td colspan="2">The design documentation for the fabrication of the heater with specified properties. The produced heater for the test model heating</td></tr>
<tr><td>4</td><td colspan="2">Produced technical project and design documentation for development of the test facility control system and DAS. Produced test facility control system and DAS with proper software. Its assembling on the test installation</td></tr>
<tr><td>5</td><td colspan="2">Re-planning and repair of the experimental site and administrative areas in a building “T”</td></tr>
</table>

Task 3

<table>
<tr><th colspan="2">Task description and main milestones</th><th>Participating Institutions</th></tr>
<tr><td colspan="2">Task “C”: carrying out of scale experiments on the VVER vessel model</td><td>1-“MPEI”
2-EDO “GP”
3-</td></tr>
<tr><th colspan="3">Description of deliverables</th></tr>
<tr><td>1</td><td colspan="2">The protocols of the scale experiments with VVER vessel models</td></tr>
</table>

Task 4

Task description and main milestones		Participating Institutions
The task "D": the manufacturing and material creep testing of the samples from VVER vessel steel and material property creep testing of the samples cut from the tested VVER vessel models		1-"IGiL" 2-"MPEI" 3- EDO "GP"
Description of deliverables		
1	The test specimens fabricated of the original VVER vessel steel and manufactured from the vessel models after experiments	
2	The protocols of the high temperature material property creep tests of the VVER vessel steel specimens	

5. Role of Foreign Collaborators/Partners

Role and type of foreign Collaborator participation in present project will be determined according to the ISTC governing documents. It is supposed, the participation of the Collaborators in this project will be carried out in the following forms:

- the information exchange during project implementation;

- joint seminars, workshops, meetings, consultations;

- verification of results using independent methods and/or equipment. It is expedient a participation of Collaborators on the carrying out the pre- and post-test simulations of the scale experiments with vessel models by means of the available SA computer codes. The results both pre- and post-test numerical simulations fulfilled by means of the various codes will preliminary allow to compare their numerical accuracy and predictive abilities. Other forms of collaboration are possible and above-stated forms of Collaborators participation in the project will be complemented in case of necessity.

6. Technical Approach and Methodology

1) **Task "À"**. The numerical simulations associated with choosing the accident scenarios and test conditions of the VVER-440 scale vessel models, will be carried out by means of the RELAP/SCDAP and MELCOR codes. Within the framework of the project is planned to consider three SA scenarios in VVER, which conditions will be reproduced on the scale experiments with vessel models. Pre-test simulations of the vessel models behaviour during scale experiments for the chosen SA scenarios will be carried out by means of the various codes at the project participants disposal. The creep and ordinary mechanical characteristics of the VVER vessel steel obtained up to 1100 C will be used within the numerical calculations. Both the thermal history of the tested vessel model and the load conditions during scale experiments will be used as the basis for post-test numerical simulations. The mechanical characteristics of the vessel steel updated in view of the results received within the material property tests in the Task "D" will be taken into account in post-test simulations. It is necessary to add, that the computer thermomechanical codes on the disposal of "MPEI" and "GP" teams are based on a finite element method.

2) **Task "B"**. Development and manufacturing of the experimental test facility and supporting systems for the VVER-440 scale vessel models testing are associated with decision of a number of the constructional and technological problems. The heater is a central component of discussed experimental test facility. The heater construction thus will work on extreme temperature conditions (more than 1500 C) during the course of a few tens hours. Because of this, the serviceability preservation of the heater will be provided by using of the special materials (ceramics etc) and refractory alloys. The heater design and its main parameters will be determined on base of the scale model testing conditions. The development and creation of the experimental installation and its auxiliary systems will assume a realization of the appropriate design works, manufacturing of the details and units of the installation, and also their assembling. It is supposed, that the additional appropriate experts and organizations will involved in performance of these tasks.

The separate attention is deserved with development and manufacturing of the VVER vessel scale models. It is supposed, that the vessel scale models will be made of the original VVER steel. Material and technology, as well as thermal treatment have to correspond the same conditions of the regular VVER vessels manufacturing. The inner diameter and wall thickness of the VVER-440 vessel scale model will be respectively ~750 mm and ~30 mm corresponding to a geometrical scale ~1:5.

The additional efforts should be directed on the providing of appropriate cooling conditions of the top part of scale model in course of an experiment, where the auxiliary constructive elements (the electrical and gas systems etc.) will be placed.

For realization of the control by test facility and data gathering during the testing it is necessary to develop the control and data acquisition (DAS) systems. It is planned to use not less than 4 channels for control by the electrical, gas and water systems, and not less than 50 channels - for experimental data gathering (temperature, vessel displacements etc) during testing. On the basis that there are the heavy test conditions (first of all, it is a high temperature), the special requirements will be placed to displacement gauges which will fix the outer model surface displacements in course of the testing.

The similar demands will be made for the video & monitoring systems, which installation is planned on the experimental test facility too.

3) **Task "C"**. The study of the VVER-440 vessel behaviour in SA conditions through the experimental and numerical investigation of the vessel scale models behaviour (the thermal and structural analyses) within transient thermal and overpressure loads. In this context the project efforts are focused on the carrying out of three tests on the scaled VVER-440 vessel models. The various heating conditions, structure loading and cooling conditions of the model will be simulated in each of these tests. It is planned, the outer surface of the model will be cooled by air only.

It is planned, three scale experiments will be carried out within this experimental program. The peaked heat flux distribution on an internal surface of the scale model will be reproduced in each of these tests. Such heat flux profile corresponds to realistic SA scenarios accompanied by the formation of a stratified melt pool in the lower plenum of the VVER-440 reactor pressure vessel.

The following cases of the hot focus location on an inner surface of the vessel wall will be investigated:

- the heat flux peak is located on the inner surface of the cylindrical vessel wall and is above (~50 mm) the welded seam (joining the elliptical lower head and a cylindrical part of the vessel model);

- the maximum of the peaked flux is located on the elliptical bottom of the scale model. The polar angle of the heat flux peak lies in the range between 75 and 85^0. The bottom center of the lower head is 0^0.

The local thickness of the vessel wall will be measured before and after tests at number points on the outer vessel surface (at least the 30 locations) that will allow to synthesize a “thickness map” of the vessel wall.

More than the 30 thermocouples on the outer and more than 6 thermocouples on the inner vessel wall surfaces will be used to measure the wall temperature during testing. The monitoring of the vessel model deformation in course of the testing will be carried out by linear displacement transducers. It is planned the measurement of the vessel displacements will be carried out at the 10 locations. There are two displacement gauges at each location (one for horizontal displacement and one for vertical displacement).

The detailed arrangement of the thermocouples and displacement transducers will be determined after choosing the SA scenarios and test conditions within the Task “A” framework.

The preparation of each experiment will include the mounting of the experimental vessel model, its equipment by necessary measuring devices and delivering to installation of the electrical power, inert gas, control and DAS systems. The dismantle and inspection of the tested vessel model will be made after realization of each test. The experimental data received as a result of the test fulfillment, will be used for carrying out the post-test simulations. The steel bars will be cut from the vessel model after testing for further manufacturing of the samples intended for the material property creep tests.

4) **Task "D"**. The considered project stage is concerned with determination of the creep characteristics and ordinary mechanical properties of the VVER vessel steel (15Kh2NMFA) in temperature range from 700 to 1200 C on the failure times from 2 to 50 hours. The necessity of similar study is dictated by the absence the enough complete creep data of this steel on the time range more than 10 hours because the creep diagrams of the mentioned steel were obtained as a rule only for the time range up to 10 hours within previous investigations.

During the material property creep experiments there will be two or three tests per temperature and stress level to evaluate the scatter of the mechanical properties. Some of these tests will be carried out at the same conditions (stress and temperature) which correspond the test conditions of the French vessel 16MND5 steel, that to allow a direct comparison of these steels.

The appropriate tests for determination of the ordinary mechanical properties of the VVER vessel steel will be carried out with tensile rate ~20 mm/min to avoid relaxation due to the creep during testing.

Within the framework of present project it is supposed to carry out the material property tests of this steel for two cases of the sample fabrication: the test specimens fabricated of the original VVER vessel steel (case #1) and manufactured of the vessel models after testing (case #2). The results of the 2-nd case tests will allow to estimate the influence of the prior heating and accumulative damage (as a result of the creep of the vessel model during the test) on the creep strength of the VVER vessel steel.

7. Technical Schedule

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Quarter 9	Quarter 10	Quarter 11	Quarter 12	Person*days
Task 1 (Task "A")	SA scenarios. Test conditions of the scale experi-ments	Seminar				Pre-test results. R&D. Seminar. Report				Seminar		Post-test results. Report. Publication	
Person*days	**150**	**150**	**150**	**120**	**127**	**100**	**100**	**0**	**93**	**90**	**210**	**100**	**1390**
Task 2 (Task "B")		Technical projects. Design documentati on				Produced Supporting and Control & DAS systems	Produced test facility and assembled the 1-st vessel model						
Person*days	**850**	**750**	**700**	**670**	**650**	**590**	**470**	**0**	**0**	**0**	**0**	**0**	**4680**
Task 3 (Task "C")								The 1-st test. Protocol of the testing. Seminar	The 2-nd test. Protocol of the testing.	The 3-rd test. Protocol of the testing. Seminar			
Person*days	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**900**	**600**	**540**	**0**	**0**	**2040**
Task 4 (Task "D")		Material test Samples (1-st series)					Creep Data testing (1-st series)			Material test Samples (2-nd series)		Creep Data testing (2-nd series). Report	
Person*days	**252**	**241**	**177**	**159**	**134**	**96**	**86**	**98**	**82**	**87**	**80**	**80**	**1572**
TOTAL	**1252**	**1141**	**1027**	**949**	**911**	**786**	**656**	**998**	**775**	**717**	**290**	**180**	**9682**

8. Personnel Commitments

8.1. Individual participants

Leading Institution: MPEI

Category I (weapon scientific and technical personnel)

Name	Birth Year	Scientific Title	Weapon Expertise Ref.	Function in project	Daily rate (US$)	Total days	Total grants (US$)
PORTYANNOY Anatoly G.	1948	Ph. D.	4.9	Designing and development of the heater's construction and auxiliary systems of the test facility. Testing of the vessel models	30.0	613	18390.0
ZAHARKIN Igor I.	1936	Ph. D.	4.9	Preparation of the test facility for experiments. The temperature analyses of the vessel models during testing	30.0	370	11100.0
MALCEV Vladimir G.	1939		4.9	The thermal analysis of the vessel models during testing. Preparation the test facility for experiments. Post-test examination of the models	30.0	336	10080.0
POLIONOV Viktor P.	1941	Ph.D.	4.9	Preparation and carrying out the scale experiments. Thermal analysis of the scale models	30.0	490	14700.0
SOROKIN Alexander P.	1948	Dr.	4.9	Preparation and carrying out the scale experiments. Pre- and post-test analysis of scale experiments	30.0	428	12840.0
BOGOMOLOV Valery N.	1939	Ph.D.	4.9	Preparation the test facility and carrying out the experiments	30.0	245	7350.0

IVANOV Evgeny F.	1939	Ph.D.	4.9	Preparation the test facility and carrying out the scale experiments. Post-test examination of the scale models	30.0	306	9180.0
BOGOSLOVSKAYA Galina P.	1951	Ph.D.	4.9	Preparation and carrying out the experiments with the VVER vessel models	30.0	245	7350.0
KALEDIN Vladimir O.	1963		1.1	Designing and development of the heater of the model. Pre- and post-test analyses of the scale experiments	30.0	605	18150.0
SLITKOV Mikhail N.	1948	Ph.D.	1.1	Preparation and carrying out the scale experiments. Post-test examination of the scale models. Manufacturing of the test samples from the vessel models after its testing	30.0	600	18000.0
					Total:	**4238**	**127140.0**

Category II (other scientific and technical personnel)

Name	Birth Year	Scientific Title	Function in project	Daily rate (US$)	Total days	Total grants (US$)
LOKTIONOV Vladimir D.	1960	Ph.D.	Project Manager	35.0	660	23100.0
RASSOKHIN Nikolay G	1923	Dr., Prof.	The scientific adviser	35.0	86	3010.0
DANILOV Vladimir L.	1945	Dr., Prof.	The analysis and interpretation of the creep tests of the VVER steel	30.0	67	2010.0
MUKHTAROV Erkin S.	1965	Ph.D.	Pre- and post-test thermal analysis of the vessel scale models	30.0	100	3000.0
YANKOV Georg Glebovich	1950	Ph.D.	Project Sub-manager. The preparation, carrying out and analysis of the VVER scale vessels testing	33.0	553	18249.0

ORLOV Vitaly A.	1972	Ph.D.	Preparation and carrying out the scale experiments	30.0	157	4710.0
ARTEMOV Valery Ivanovich	1951	Ph.D.	Development of the accident scenarious and conditions of the vessel scale testing. Pre- and post-test simulations of the scale experiments. Preparation and carrying out the scale experiments	30.0	463	13890.0
SIDOROV Alexandr S.	1955	Ph.D.	Development of the scenarious of the vessel scale tests. Preparation and carrying out the scale experiments	30.0	70	2100.0
SHVETC Vasily Gr.	1974		Development of the videomonitoring system. Preparation and carrying out the scale tests	25.0	80	2000.0
				Total:	**2236**	**72069.0**

Category III (participant personnel)

Name	**Birth Year**	**Function in project**	**Daily rate (US$)**	**Total days**	**Total grants (US$)**
FESENKO Nataly D.	1953	The secretary	20.0	210	4200
YAROSHENKO Nikolay I.	1965	The preparation of the initial dada for pre-test calculations	20.0	80	1600
			Total:	**290**	**5800**

Category IV (personnel, who will work less than 10% of project duration)

Number of persons	**Function in project**	**Daily rate (US$)**	**Total days**	**Total grants (US$)**
1	Technician	20.0	57	1140.0
1	Translater	20.0	20	400.0
		Total:	**77**	**1540.0**

Participant Institution 1: EDO GP

Category I (weapon scientific and technical personnel)

Name	Birth Year	Scientific Title	Weapon Expertise Ref.	Function in project	Daily rate (US$)	Total days	Total grants (US$)
BANYUK Gennadiy F.	1946	Ph.D.	4.9	The scientific adviser	22.0	250	5500.0
SEROSHTAN Sergey I.	1954		4.9	Pre- and post-test thermal analyses of the vessel scale models	25.0	214	5350.0
STOBECKY Andrey A.	1973		4.9	Post-test examinations of the vessel scale models	25	206	5150.0
					Total:	**670**	**16000.0**

Category II (other scientific and technical personnel)

Name	Birth Year	Scientific Title	Function in project	Daily rate (US$)	Total days	Total grants (US$)
SEMISHKIN Valery P.	1947	**Ph.D.**	Project Sub-manager	33.0	256	8448.0
PAGETNOV Vladimir V.	1953	Ph.D.	Analyses of the SA scenarious in VVER and preparation of the initial data for numerical simulations	30.0	230	6900.0
FRIZEN Evgeny A.	1974	Ph.D.	Pre- and post-test structural analyses of the vessel scale models	30.0	230	6900.0
MERKUN Oleg G.	1976		Post-test examination of the vessel models	25.0	160	4000.0
CHURKIN Andrey N.	1973	Ph.D.	Pre-test temperature analyses of the vessel scale models	30.0	60	1800.0
Yudina Tatyana A.	1966		Post-test structural analysis of the vessel models	25.0	116	2900.0
				Total:	**1052**	**30948.0**

Category III (participant personnel)

Name	Birth Year	Function in project	Daily rate (US$)	Total days	Total grants (US$)
			Total:		

Category IV (personnel, who will work less than 10% of project duration)

Number of persons	Function in project	Daily rate (US$)	Total days	Total grants (US$)
2	Preparation of initial data for numerical simulations	20	82	1640
1	Preparation of the R&D reports and protokols	20	60	1200
		Total:	**142**	**2840.0**

Participant Institution 2: IGiL

Category II (other scientific and technical personnel)

Name	Birth Year	Scientific Title	Function in project	Daily rate (US$)	Total days	Total grants (US$)
SOSNIN Oleg V.	1926	**Dr., Prof.**	Project Sub-manager	33.0	250	8250.0
GOREV Boris V.	1947	Dr.	Material property testing of the VVER vessel steel	30.0	225	6750.0
LYUBASHEVSKAYA Irina V.	1964	Ph.D.	Material creep testing of the vessel steel	30.0	260	7800.0
TSVELODUB Igor Yu.	1952	Dr., Prof.	Analysis of the creep tests of VVER vessel steel and development of the creep model	30.0	160	4800.0
				Total:	**895**	**27600.0**

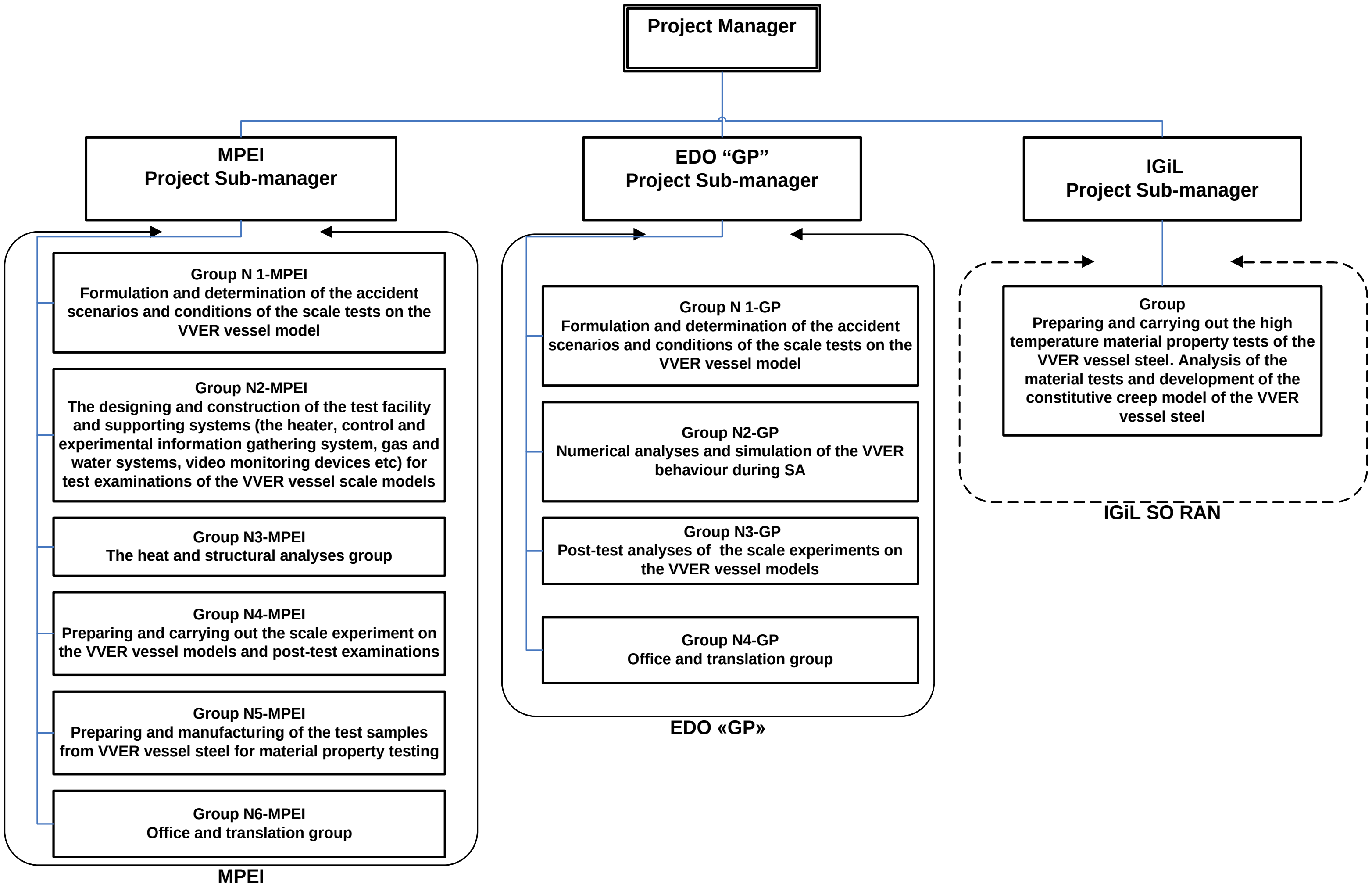
Category III (participant personnel)

Name	Birth Year	Function in project	Daily rate (US$)	Total days	Total grants (US$)
GAGARIN Yury V.	1960	Preparation of the material property testing of the VVER vessel steel	20	82	1640
			Total:	**82**	**1640**

Category IV (personnel, who will work less than 10% of project duration)

Number of persons	Function in project	Daily rate (US$)	Total days	Total grants (US$)
		Total:		

8.2. Managerial responsibilities



9. Financial Information

TABLE 1

Estimated Aggregated Expenditures by Recipient

Category	Quarters 1 & 2		Year 1		Year 2		Year 3		Total	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
1 Grant Payments:										
1.1 Category I		35968		71936		50636		20568		143140
1.2 Category II		34788		58586		41756		30275		130617
1.3 Category III		3120		4620		2780		40		7440
1.4 Category IV		1580		2500		960		920		4380
Total Grant Payments		**75456**		**137642**		**96132**		**51803**		**285577**
2 Equipment:										
2.1 Capital Equipment										
2.2 Non-Capital Equipment		50571		50571						50571
Total Equipment		**50571**		**50571**						**50571**
3 Materials/Supplies	**841**	**5123**	**2243**	**5300**	**1682**	**1836**	**280**	**752**	**4205**	**7888**
4 Bank Fees		**756**		**1377**		**962**		**519**		**2858**
5 Other Direct Costs:										
5.1 Technological Energy						1260		840		2100
5.2 Communications	550		1130		1160		610		2900	
5.3 Subcontracts/Seminars	719	66905.2	719	133810.4	719	33452.6	719	0	2157	167263
5.4 Logistics/Customs										
5.5 Other	520		1560		2080		1560		5200	
Total ODC	**1789**	**66905.2**	**3409**	**133810.4**	**3959**	**34712.6**	**2889**	**840**	**10257**	**169363**
6 Travel:										
6.1 Internal ***	900		2300		2300		1400		6000	
6.2 Outside CIS		3000		7000		7000		4000		18000
Total Travel	**900**	**3000**	**2300**	**7000**	**2300**	**7000**	**1400**	**4000**	**6000**	**18000**
Overhead/Retainage	....	....	....	....	....	....	....	....	15760	....
Subtotals	**3530**	**201811.2**	**7952**	**335700.4**	**7941**	**140642.6**	**4569**	**57914**	**36222**	**534257**
Totals	**205341.2**		**343652.4**		**148583.6**		**62483**		**570479**	

Remarks: *(1) - Cash flow through Recipient Account

** (2) - Cash flow through ISTC

*** Include Local and inside CIS travel

TABLE 1-1

Estimated Aggregated Expenditures by Leading Institution

Category	**Quarters 1 & 2**		**Year 1**		**Year 2**		**Year 3**		**Total**	
	(1)	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
1 Grant Payments:										
1.1 Category I		33000		66000		44700		16440		127140
1.2 Category II		24690		38390		21560		12119		72069
1.3 Category III		2720		3820		1980				5800
1.4 Category IV		1100		1540						1540
Total Grant Payments		**61510**		**109750**		**68240**		**28559**		**206549**
2 Equipment:										
2.1 Capital Equipment										
2.2 Non-Capital Equipment		38571		38571						38571
Total Equipment		**38571**		**38571**						**38571**
3 Materials/Supplies	**841**	**4123**	**2243**	**4300**	**1682**	**1836**	**280**	**752**	**4205**	**6888**
4 Bank Fees		**616**		**1098**		**683**		**286**		**2067**
5 Other Direct Costs:										
5.1 Technological Energy						1260		840		2100
5.2 Communications	520		1040		1040		520		2600	
5.3 Subcontracts/Seminars	719	65305.2	719	130610.4	719	32652.6	719		2157	163263
5.4 Logistics/Customs										0
5.5 Other	450		1350		1800		1350		4500	
Total ODC	**1689**	**65305.2**	**3109**	**130610.4**	**3559**	**33912.6**	**2589**	**840**	**9257**	**165363**
6 Travel:										
6.1 Internal ***	500		1500		1500		1000		4000	
6.2 Outside CIS		2000		4000		4000		2000		10000
Total Travel	**500**	**2000**	**1500**	**4000**	**1500**	**4000**	**1000**	**2000**	**4000**	**10000**
Overhead/Retainage	....	....	....	....	....	....	....	....	12218	....
Subtotals	**3030**	**172125.2**	**6852**	**288329.4**	**6741**	**108671.6**	**3869**	**32437**	**29680**	**429438**
Totals	**175155.2**		**295181.4**		**115412.6**		**36306**		**459118**	

Remarks: *(1) - Cash flow through Recipient Account

** (2) - Cash flow through ISTC

*** Include Local and inside CIS travel

TABLE 1-2

Estimated Aggregated Expenditures by Participant Institution 1

Category		Quarters 1 & 2		Year 1		Year 2		Year 3		Total	
		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
1	**Grant Payments:**										
1.1	Category I		2968		5936		5936		4128		16000
1.2	Category II		5352		10704		10704		9540		30948
1.3	Category III										0
1.4	Category IV		480		960		960		920		2840
	Total Grant Payments		**8800**		**17600**		**17600**		**14588**		**49788**
2	**Equipment:**										
2.1	Capital Equipment										
2.2	Non-Capital Equipment										
	Total Equipment										**0**
3	**Materials/Supplies**										**0**
4	**Bank Fees**		**88**		**176**		**176**		**146**		**498**
5	**Other Direct Costs:**										
5.1	Technological Energy										
5.2	Communications										
5.3	Subcontracts/Seminars										
5.4	Logistics/Customs										
5.5	Other										
	Total ODC										**0**
6	Travel:										
6.1	Internal ***										
6.2	Outside CIS		500		1500		1500		1000		4000
	Total Travel		**500**		**1500**		**1500**		**1000**		**4000**
	Overhead/Retainage	....	....	....	....	....	....	....	....	2012	....
	Subtotals		**9388**		**19276**		**19276**		**15734**	**2012**	**54286**
	Totals	**9388**		**19276**		**19276**		**15734**		**56298**	

Remarks: *(1) - Cash flow through Recipient Account
** (2) - Cash flow through ISTC
*** Include Local and inside CIS travel

TABLE 1-3

Estimated Aggregated Expenditures by Participant Institution 2

Category		Quarters 1 & 2		Year 1		Year 2		Year 3		Total	
		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
1	**Grant Payments:**										
1.1	Category I										0
1.2	Category II		4746		9492		9492		8616		27600
1.3	Category III		400		800		800		40		1640
1.4	Category IV										0
	Total Grant Payments		**5146**		**10292**		**10292**		**8656**		**29240**
2	**Equipment:**										
2.1	Capital Equipment										
2.2	Non-Capital Equipment		12000		12000						12000
	Total Equipment		**12000**		**12000**						**12000**
3	**Materials/Supplies**		**1000**		**1000**						**1000**
4	**Bank Fees**		**52**		**103**		**103**		**87**		**293**
5	**Other Direct Costs:**										
5.1	Technological Energy										
5.2	Communications	30		90		120		90		300	
5.3	Subcontracts/Seminars		1600		3200		800				4000
5.4	Logistics/Customs										
5.5	Other	70		210		280		210		700	
	Total ODC	**100**	**1600**	**300**	**3200**	**400**	**800**	**300**		**1000**	**4000**
6	Travel:										
6.1	Internal ***	400		800		800		400		2000	
6.2	Outside CIS		500		1500		1500		1000		4000
	Total Travel	**400**	**500**	**800**	**1500**	**800**	**1500**	**400**	**1000**	**2000**	**4000**
	Overhead/Retainage	....	....	....	....	....	....	....	....	1530	....
	Subtotals	**500**	**20298**	**1100**	**28095**	**1200**	**12695**	**700**	**9743**	**4530**	**50533**
	Totals	**20798**		**29195**		**13895**		**10443**		**55063**	

Remarks: *(1) - Cash flow through Recipient Account
** (2) - Cash flow through ISTC
*** Include Local and inside CIS travel

10. Equipment and Materials Summary

10.1. Equipment Summary

TABLE 2

EQUIPMENT/MATERIAL SUMMARY						
EQUIPMENT SUMMARY for Project Agreement #3635 To be provided in kind [X] To be purchased by recipient [ ]						
The ISTC will normally provide the most appropriate equipment that will perform the functions required; however, if very special reasons are given and explained in detail (Form PR-2E), the purchase of a particular make will be considered.						
Please list items in the order of their priority and put an 'X' in the column next to "Item no." if ISTC form PR-2E, "Data for a Single Equipment Item', has been completed for a given item and is attached.						
Item No.		**DESCRIPTION OF ITEM**	**Date needed (quarter)**	**Qty**	**Unit cost (USD)**	**Amount (USD)**
Leading Institution: MPEI						
1		The linear displacement transducers (contact type, 0-70 mm, T <275 C)	2	30	747	22410
2		Notebook Toshiba Qosmio F30-141 (PQF32E-00G011)	1	1	1700	1700
3		Cable thermocouples (d=1.0 mm, T< 1400 C)	2	40	55.55	2222
4		LCD Monitor Samsung 19" SM 940T	1	1	375	375
5		LCD Monitor Samsung 17" SM 731BF	1	2	240	480
6		LCD Monitor NEC 17" LCD70GX2-Pro	1	1	360	360
7		Office Center HP LJet 3050	1	1	392	392
8		Office Center Xerox3119	1	1	215	215
9		Printer HP LJ 1018	1	1	136	136
10		Colour Printer HP DeskJet 5943	1	1	110	110
11		Scaner_EPSON_V350	1	1	177	177
12		Fax PANASONIC KX-FL403RU	1	1	280	280
13		UPS PowerCom IMP-625AP	1	2	85	170
14		UPS IMD-825AP	1	1	120	120
15		Modem Zyxel P-2602R	1	1	150	150
16		Radio Telephone PANASONIC KXTCD-205RU	1	1	61	61
17		KX-TCA120 DECT (Additional tube KXTCD-205)	1	2	26	52
18		Proektor Multymed INFOCUS IN32	1	1	1150	1150
19		Digital Photo Camera Canon EOS 350D Lens Kit (18-55)	1	1	761	761
20		Colour_camera EverFocus EQ-350/P	1	3	200	600

21		Lens FINE FL 04318 NI (f=6 mm, f=12mm)	1	6	14	84
22		Photosupport Continent SET1	1	3	27	81
23		Radio commun. Midland_GTX400 + charger	2	1	169	169
24		D-Link DP-G321 (print-server USB)	1	1	106	106
25		External HDD 160Gb WDXMS1600TE (USB2.0)	1	2	190	380
26		Office chair “Charly”	1	5	92	460
27		Armchair “Djuno”	1	3	206	618
28		Chair “RIO”	1	6	29	174
29		Case HB4-4	1	1	323	323
30		Metal Rack MC-245	1	2	100	200
31		The safe "VALBERG" ASM-63T	1	1	279	279
32		Metal Rack AMT1891	1	1	406	406
33		Office furniture set	1	5	551	2755
34		The wall screen Vega 2.0x2.0(WS_V_200-S)	1	1	134	134
35		LAMINATOR Fujipla 2313	1	1	156	156
36		The brochurator BINDSTREAM M08	1	1	115	115
37		Office accessories	1	1	210	210
					Subtotal:	**38571**
Participant Institution 2: IGiL						
1		Rotary Gauges RF701-485	2	5	469	2345
2		The displacement transducers RF205-55-5-m-485	2	5	496	2480
3		The displacement transducers RF204-10-1-m-485	2	5	415	2075
4		The displacement transducers RF206-5-1-m-485	2	5	409	2045
5		The temperature regulator IR	2	5	407	2035
6		The 2-channel system with induction converters for linear measurements	2	1	1020	1020
					Subtotal:	**12000**
					Estimated TOTAL COST:	**50571**

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10.2. Materials Summary

TABLE 3

EQUIPMENT/MATERIAL SUMMARY

MATERIAL SUMMARY

for Project Agreement #3635

To be provided in kind [X]

To be purchased by recipient [ ]

The ISTC will normally provide the most appropriate equipment that will perform the functions required; however, if very special reasons are given and explained in detail (Form PR-2E), the purchase of a particular make will be considered.

Please list items in the order of their priority and put an 'X' in the column next to "Item no." if ISTC form PR-2E, "Data for a Single Equipment Item', has been completed for a given item and is attached.

Item No.		DESCRIPTION OF ITEM	Date needed (quarter)	Qty	Unit cost (USD)	Amount (USD)
Leading Institution: MPEI						
1		Argon (bottle-stored)	6-10	40	22	880
2		Water, m3 (800 m3)	6-10	800	1.25	1000
3		Catridge for the HP LJ 3050, HP DJ5943, Xerox3119	4-8	15	59	885
4		PC case: Foxconn:FOX-TLA+-475-500PP	1	3	67	201
5		Videocard Pinnacle Systems Studio MovieBox Plus 710-USB V.10	1	1	194	194
6		DVR DIT-4 Pro (4-channel videocapture card)	1	1	463	463
7		Motherboard ASUS P5WDG2 WS LGA775 i975X ATx	1	1	295	295
8		MB (Motherboard) Gigabyte GA-M61P-S3	1	1	89	89
9		MB Gigabyte GA-965P-S3	1	1	114	114
10		Processor Intel Core 2 Duo E6600 2.40 GHz	1	1	255	255
11		CPU AMD ATHLON 64 X2 5200+	1	1	194	194
12		CPU INTEL Core 2 Duo E6300 (1,87GHz) LGA775	1	1	190	190
13		Videocard Foxconn GF 7600GT 256Mb DDR3 128bit Tv-out	1	1	122	122
14		Videocard Leadtek GF 7600GT 256Mb DDR3 128bit Tv-out	1	2	122	244
15		Memory Samsung DDR-II 1GB (PC2-6400) 800MHz	1	3	70	210
16		DVD-RW/+RW (NEC AD-7173S, PIONEER DVR-212DBK, TEAC DV-W516G/E	1	5	38.8	194
17		CPU Cooler Master Aquagqte R120 (RL-MUA-EBU1)	1	1	67	67
18		Cooler ZALMAN CNPS9500AM2	1	1	59	59
19		FDD 3.5" 1.44M Mitsumi	1	3	6	18
20		HDD 250Gb WD Caviar 7200 16 mb cache S-ATA2	1	3	73	219
21		HDD Seagate 250 Gb ST3250620A (Ultra ATA100)	1	3	69	207

22		Audio card Creative_SB0359SB Audigy-2 ZS, 7.1 PCI	1	3	41	123
23		AC filter Pilot-GL-4 (v.5.6_3)	1	3	20	60
24		AC filter Defender_DFS_805(5m)	1	3	27	81
25		USB 2.0 Transcend JetFlash V60 Drive 2Gb	1	5	29	145
26		USB 2.0 Kingston USB Memory 2Gb	1	4	31.5	126
27		Keyboard Mitsumi Ergonomic (KFK-EA4SA) PS/2	1	6	10	60
28		Logitech Wheel Mouse Optical BD/BJ/BT-58	1	6	10	60
29		Labtec Wireless optical Mouse 800	1	2	22	44
30		The calculator CASIO_DJ240_DP	1	1	28	28
31		The calculator CASIO_FX100MS	1	2	30.5	61
					Subtotal:	**6888**
Participant Institution 2: IGiL						
1		Cable thermocouple TPP 5.182.002-43 (0,3) 1m	2	3	280	840
2		Cable thermocouple THA 9419-22 2m	2	10	16	160
					Subtotal:	**1000**
					Estimated TOTAL COST:	**7888**

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TABLE 3-1

EQUIPMENT/MATERIAL SUMMARY

MATERIAL SUMMARY

for Project Agreement #3635

To be provided in kind [ ]

To be purchased by recipient [X]

The ISTC will normally provide the most appropriate equipment that will perform the functions required; however, if very special reasons are given and explained in detail (Form PR-2E), the purchase of a particular make will be considered.

Please list items in the order of their priority and put an 'X' in the column next to "Item no." if ISTC form PR-2E, "Data for a Single Equipment Item', has been completed for a given item and is attached.

Item No.		DESCRIPTION OF ITEM	Date needed (quarter)	Qty	Unit cost (USD)	Amount (USD)
Leading Institution: MPEI						
1		Disks (CD-RW, CD-R, DVD+RW, DVD+R)	1-10	400	1	400
2		Office goods	1-10	10	100	1000
3		Cable thermocouple (d=1.0 mm, T< 1800 C)	2-6	25	67.4	1685
4		Cable thermocouple (d=1.0 mm, T< 1300 C)	2-6	50	22.4	1120
					Subtotal:	**4205**
					Estimated TOTAL COST:	**4205**

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10.4. Other Direct Costs Summary

TABLE 4

OTHER DIRECT COSTS SUMMARY						
OTHER DIRECT COSTS SUMMARY for Project Agreement #3635 To be provided in kind [X] To be purchased by recipient [ ]						
Detailed breakdown of Other Directs Costs to include planned activities under items 5.1, 5.2, 5.3, 5.4, 5.5 from Table 1 of the Project Agreement						
Item No.		**DESCRIPTION OF ITEM**	**Date needed (quarter)**	**Qty**	**Unit cost (USD)**	**Amount (USD)**
Leading Institution: MPEI						
1	5.1	Electrical energy (380 V), (30 000 kW*hour)	6-10	30000	0.07	2100
3	5.3	1) Subcontract #1: the development and manufacturing, assembling of experimental test facility and auxiliary systems (gas, electrical, water) on an experimental site for VVER model testing – 67000 US; 2) Subcontract #2: Development and creation of the control and DAS systems. Installation of these systems on an experimental test facility – 23000 USD; 3) Subcontract #3: mechanical preparation of the material test samples from the VVER vessel and cutting/manufacturing of the test samples from the vessel models after scale experiments – 12263 USD; 4) Subcontract #4: development of a construction and manufacturing of a heater of the VVER scale models – 24900 USD; 5) Subcontract #5: the manufacturing of the VVER vessel scale models (4 pieces)–20500 USD; 6) Subcontract #6: Reconstruction and repair of the experimental areas (cell #5, S = 70 m2) and working rooms in “T” building (two rooms by the common area S = 40 m2) – 15600 USD	1-5	1	163263	163263
					Subtotal:	**165363**
Participant Institution 2: IGiL						
3	5.3	The subcontracts (manufacturing of adaptations for testing of the samples and its finishing treatment)	1-5	5	800	4000
					Subtotal:	**4000**
					Estimated TOTAL COST:	**169363**

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TABLE 4-1

OTHER DIRECT COSTS SUMMARY

OTHER DIRECT COSTS SUMMARY

for Project Agreement #3635

To be provided in kind [ ]

To be purchased by recipient [X]

Detailed breakdown of Other Directs Costs to include planned activities under items 5.1, 5.2, 5.3, 5.4, 5.5 from Table 1 of the Project Agreement						
Item No.		**DESCRIPTION OF ITEM**	**Date needed (quarter)**	**Qty**	**Unit cost (USD)**	**Amount (USD)**
Leading Institution: MPEI						
2	5.2	Telephone	1-10	10	260	2600
3	5.3	Seminars and working meetings	2, 6, 10	3	719	2157
5	5.5	1) Accounting. Book-keeping – 2200 USD; 2) Report issue and transportation of the equipment – 2300 USD	2-11	10	450	4500
					Subtotal:	**9257**
Participant Institution 2: IGiL						
2	5.2	Telephone	2-11	10	30	300
5	5.5	Accounting. Report issue	2-11	10	70	700
					Subtotal:	**1000**
					Estimated TOTAL COST:	**10257**

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