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|  | PROJECT PROPOSAL | #3702 |

## I. Summary Project Information

### 1. Project Title and Taxonomy

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| --- | --- | --- | --- | --- |
| **Full title:** | Long-term Behavior of Corium after Accident (Using the Data of the Chernobyl NPP Accident) | | | |
| **Short title:** | | Long-term Behavior of Corium after Accident | | |
| **Technology area:** | | | FIR-DEC. | |
| **Category of technology development:** | | | | Basic Research, Applied Research. |

### 2. Project Manager

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Name:** | | BOROVOI Alexander Alexandrovich | | | | | | |
| **Title:** | Full Doctor in Physics & Mathematics, Honored Specialist in Science & Technology | | | | **Position:** | | Head of Department | |
| **Street address:** | | | | 25-1 General Glagolev str., apt. 8 | | | | |
| **City:** | Moscow | | | | **Region:** | |  | |
| **ZIP:** | 123103 | | | | **Country:** | | | Russia |
| **Tel.:** | (495) 197-56-59, (495) 196-90-92 | | | | **Fax:** | (495) 196-61-08 | | |
| **E-mail:** | | | borovoi@online.ru | | | | | |

### 3. Participating Institutions

#### 3.1. Leading Institution

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Short reference:** | | | | | RRC “KI” | | | | | | |
| **Full name:** | | | Federal State Institution Russian Research Center “Kurchatov Institute” | | | | | | | | |
| **Street address:** | | | | 1, Kurchatov square | | | | | | | |
| **City:** | Moscow | | | | | | | **Region:** | |  | |
| **ZIP:** | 123182 | | | | | | | **Country:** | | | Russia |
| **Name of Signature Authority:** | | | | | | | CHAIVANOV Boris Borisovich | | | | |
| **Title:** | Full Doctor of Chemical Sciences | | | | | | | **Position:** | | First Deputy Director on R&D | |
| **Tel.:** | (095) 196-95-27 | | | | | | | **Fax:** |  | | |
| **E-mail:** | |  | | | | | | | | | |
| **Governmental Agency:** | | | | | | Ministry of Education and Science | | | | | |

#### 3.2. Other Participating Institutions

No

### 4. Foreign Collaborators/Partners

#### 4.1. Collaborators

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Institution:** | | | | Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH | | | | | | |
| **Street address:** | | | | | 200, Kürfürstendam | | | | | |
| **City:** | Berlin | | | | | **Region/State:** | | | | Berlin |
| **ZIP:** | 10719 | | | | | **Country:** | | | Germany | |
| **Person:** | | | Günter Pretsch | | | | | | | |
| **Title:** | | Doctor of Science | | | | **Position:** | | Head of Department | | |
| **Tel.:** | 49-30-88-58-91-45 | | | | | **Fax:** | 49-30-88-23-655 | | | |
| **E-mail:** | | | prg@grs.de | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Institution:** | | | | Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH | | | | | | |
| **Street address:** | | | | | 200, Kürfürstendam | | | | | |
| **City:** | Berlin | | | | | **Region/State:** | | | | Berlin |
| **ZIP:** | 10719 | | | | | **Country:** | | | Germany | |
| **Person:** | | | Teske Hartmuth | | | | | | | |
| **Title:** | | Doctor of Science | | | | **Position:** | | Head Eastern Europe Department | | |
| **Tel.:** | 49-30-88-58-91-45 | | | | | **Fax:** | 49-30-88-23-655 | | | |
| **E-mail:** | | | the@grs.de | | | | | | | |

#### 4.2. Partners

No

### 5. Project Duration

30 months

### 6. Project Location and Equipment

|  |  |
| --- | --- |
| **Institution** | **Location, Facilities and Equipment** |
| **Leading Institution** | Moscow, RRC “KI” premises: Main Building, Building # 5(а), Laboratory Equipment, Personal Computers |

### 7. Total Project Effort

|  |  |
| --- | --- |
| **Total number of participants** | 19 |
| **Number of weapon scientists and engineers** | 13 |
| **Total project effort (person\*days)** | 9375 |
| **Total project effort of weapon scientists and engineers (person\*days)** | 6250 |

### 8. Financial Information

#### 8.1. Estimated Project Costs

|  |  |
| --- | --- |
| **Estimated total cost of the project (US $)** | 345000 |
| *Including:* |  |
| **Payments to Individual Participants** | 264725 |
| **Equipment** | 20000 |
| **Materials** | 10000 |
| **Other Direct Costs** | 20000 |
| **Travel** | 20000 |
| **Overhead** | 10275 |

#### 8.2. Funding Sources

|  |  |
| --- | --- |
| **Estimated total cost of the project (US $)** | 345000 |
| *Financial Sources:* |  |
| **Requested from the ISTC** | 345000 |
| **Other financial source 1** | 0 |
| *Non-Financial Sources:* |  |
| **Non-financial source 1** | 0 |

### 9. Summary of the project

At present RRC “Kurchatov Institute” jointly with the Nuclear Safety Institute of the Russian Academy of Sciences (IBRAE RAS) are implementing the ISTC Project #2916 **“**CHESS” “Development of the Models for Nuclear Fuel Behavior during Active Phase of Chernobyl Accident”.

The project is aimed at **systematizing a huge body of data on lava-like fuel-containing materials collected over 20 years of investigations at the “Shelter”, generating a database on their basis and developing models of the processes of lava generation and spreading during the early post-accident days.**

After spreading, 1200 t of “lava” inside the “Shelter” have been during 20 years under the impact of external (humidity, temperature) and internal (its own radioactive emanation) factors and have degraded gradually.

As intended presently, many more decades will pass prior to removal of “lava” out of the new confinement and its ultimate disposal.

Thus at the following phase one should **develop and justify models of “lava” behavior and degradation over a protracted period of time** (up to its removal ≤ 100 years) ‑ **this is the content of the present proposal for a new ISTC Project “CHESS – 2”.**

Based on the models developed, recommendations on optimum establishment of barriers to prevent nuclear and radiation hazard at the Chernobyl NPP during “lava” storage and removal may be proposed.

The development of such-type models is of interest for the whole category of hypothetical accidents accompanied with corium generation.

Just as in case of Chernobyl, works on corium removal and disposal might begin not immediately after an accident and thus would require a protracted period of time. In such a case the model might be useful for the development of corium retention devices for PWR, BWR and VVER power projects.

**The Project “CHESS-2” shall answer a series of specific questions.**

After the end of the active accident phase 20 years have elapsed. What processes have occurred with the “lava” during the period indicated? What processes will take place in the future during the time of awaiting removal of “lava” for several more decades under new-confinement conditions?

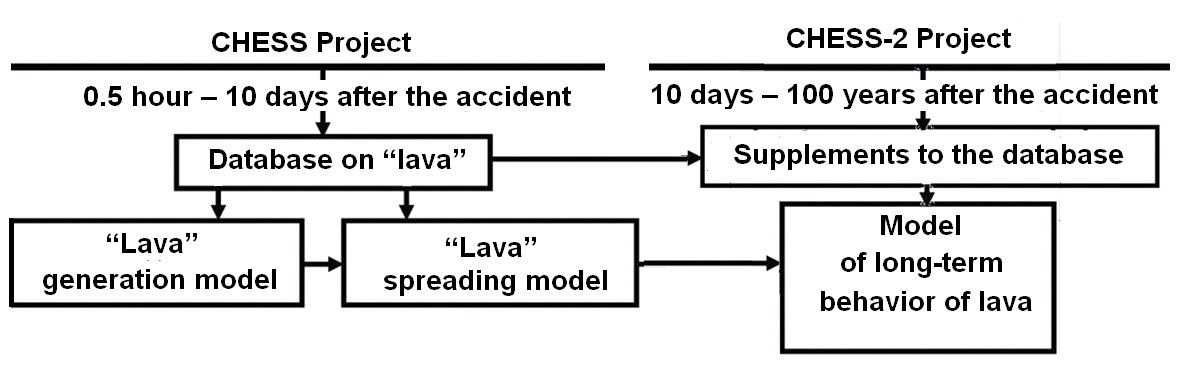
What physical and chemical processes and what external and internal mechanisms may have effect on “lava” degradation? What is the role of self-irradiation?

Whether or not “lava” will transform into fine fuel dust over the period in question? Whether or not soluble uranium compounds will be generated on its basis; and what will be the radiation hazard in the course of removal?

What countermeasures may be taken in case of hazard, and what safety barriers may be recommended for use under the “Shelter” conditions?

What general recommendations on safe protracted storage of corium may be proposed?

The interfaces between the Projects “CHESS” and “CHESS-2” and their main objectives are demonstrated in the below diagram.



The use of the “CHESS” Project database in “CHESS–2” Project is intended.

In addition, the database will be substantially supplemented with new sections addressing possible radiation and chemical causes of lava degradation.

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## II. Detailed Project Information

### 1. Introduction and Overview

1.1. Main Objectives of “CHESS” and “CHESS–2” Projects

The Chernobyl experience achieved at such a high cost can and must be used **at a maximum** and **at the international level to increase safety of nuclear power.**

The Projects “CHESS” and “CHESS–2” are dealing with the experience collected while studying fuel of the collapsed reactor that formed a specific lava (corium). More than 1200 t of such “lava” are presently located inside the “Shelter”.

Specific objectives of the projects consist in:

1. Obtaining, performing a scientific analysis and systematizing the data and parameters of corium condition at characteristic phases of its behavior (periods: immediately after the accident and next – during the following 20 years).
2. Simulation and long-term prediction of the behavior of “lava” during subsequent decades – up to 100 years ahead in the course of its storage in the “Shelter” under the new confinement.
3. Elaborating recommendations on safety measures during storage and ultimate removal of “lava” from the “Shelter”.
4. In addition, information on “lava” properties is essential to the developers of traps and other shielding barriers for new Nuclear Power Plants (NPP).

***At the first phase*** one should comprehend the achieved information on the processes (virtually unrepeatable in laboratory conditions while considering their scale) that went on during high-temperature interactions of tens of tons of irradiated nuclear fuel with surrounding materials.

In the course of such interactions a variety of types of radioactive lava were generated, which then spread over lower rooms of the Unit and solidified.

Since April 26, 1986 “lava” properties have been continuously monitored throughout the following 20 years. There are now almost 7000 records of “lava” properties, hundreds of high-quality descriptions and a variety of photo- and video- materials.

The first phase of the work is aimed at **systematizing a huge body of collected facts**, **developing a database** **on their basis, and generating models of the processes of “lava” formation and spreading during the early post-accident days** (0.5 hour – 10 days after the accident).

The ISTC Project #2916“Development of the Models for Nuclear Fuel Behavior during Active Phase of Chernobyl Accident” **– “**CHESS” pursues this objective (executors: RRC KI and IBRAE RAS).

After spreading, 1200 t of “lava” inside the “Shelter” have been during 20 years under the impact of external (humidity, temperature) and internal (its own radioactive emanation) factors and have degraded gradually.

As intended presently, many more decades will pass prior to removal of “lava” out of the new confinement and its ultimate disposal.

Thus at the following ***second phase*** one should **develop and justify models of “lava” behavior and degradation over a protracted period of time** (up to its removal ≤ 100 years) ‑ **this is the content of the present proposal for a new ISTC Project “CHESS – 2”.**

Based on the models developed, recommendations on optimum establishment of barriers to prevent nuclear and radiation hazard at the Chernobyl NPP during “lava” storage and removal could be proposed.

Long-term forecasts of corium behavior for different corium retention devices developed for PWR, BWR and VVER power projects could be generated.

It is obvious that first and foremost the objectives of the projects are related to **practical activities on elimination of the Chernobyl accident consequences.**

Works are presently underway in Chernobyl on transformation of the “Shelter” into a more environmentally safe condition under financial, technical and organizational support of the whole international community.

Many activities on stabilization of building structures have been already completed. The construction of a new safe confinement (an “Arc”) and its moving up to the existing “Shelter” is the order of the day. At this point works under SIP (Shelter Implementation Plan) come to an end, but “Shelter” transformation plans are not brought to completion.

Removal of nuclear fuel and radioactive materials from the “Shelter” and their ultimate disposal should be the following – the most difficult – step.

It is at that step that the results of ISTC’s projects “CHESS” and “CHESS–2”*would help in both the establishment of monitoring systems and the elaboration of recommendations on technical operations with “lava” to prevent potential accidents, contribute to the development of optimum “lava”-removal technologies and thus diminish material expenses and the dose burden.*

1.2. Objectives of “CHESS-2” Project and Its Peculiarities

“CHESS-2” Project should answer many specific questions.

After the end of the active accident phase 20 years have elapsed. What processes have occurred with the “lava” during the period indicated? What processes will take place in the future during the time of awaiting removal and disposal of “lava” for several more decades (up to 100 years)?

What physical and chemical processes and what external and internal mechanisms may have effect on “lava” degradation? What is the role of self-irradiation?

Whether or not “lava” will transform into fine fuel dust over the period in question? Whether or not soluble uranium compounds will be generated on its basis; and what will be the radiation hazard of such transformations?

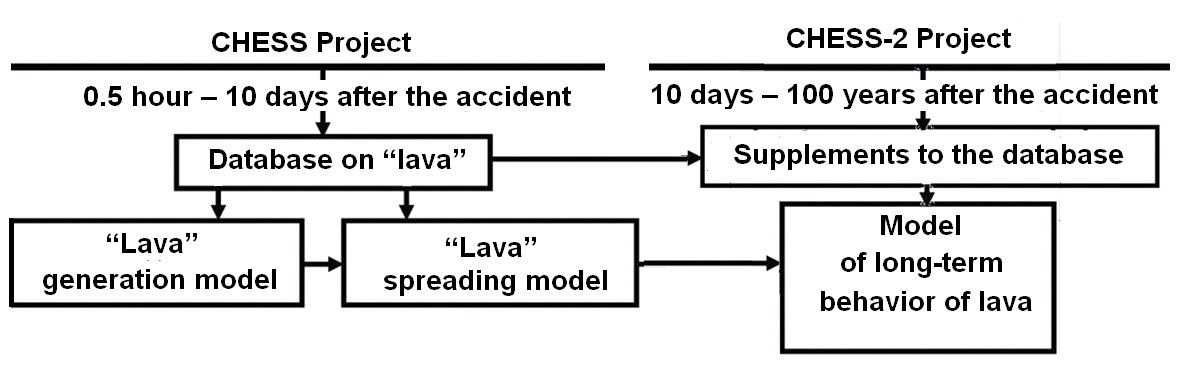
What countermeasures may be taken in case of hazard, and what safety barriers may be recommended for use under the “Shelter” conditions?

What general recommendations on safe protracted storage of corium could be proposed?

**The proposal is to develop within the Project a model of the long-term behavior of “lava” under the “Shelter” conditions** (10 days – 100 years taking account of works on the “Shelter” transformation) **and to issue on its basis general recommendations on increasing safety of corium storage and removal.**

While pursuing common objectives, the Projects “CHESS” and “CHESS–2” are solving different tasks through the use of quite different methods.

The interfaces between the Projects “CHESS” and “CHESS-2” and their major distinctions are demonstrated in the below diagram.



The use of the whole “CHESS” Project database in “CHESS–2” Project is intended.

In addition, the database will be supplemented with new sections related to possible radiation and chemical causes of lava degradation, such as:

- data on microstructure of different “lava” types;

- data describing α-, β- and γ - radiation sources in the “lava” and the dynamics of buildup of absorbed dose from such sources;

- information on the most important chemical reactions that could lead to degradation of “lava” materials or, on the contrary, to slow down such degradation;

- results of material investigations of causes and dynamics of degradation of vitrified waste –“lava” analogues.

It is intended to continue investigations of “lava” samples from the “Shelter” and monitoring of samples being at special storages of several institutes.

1.3. Topicality of “CHESS-2” Project

**Firstly,** the work topicality is due to the need of resolving specific practical tasks during transformation of the “Shelter”.

The model to be generated will make it possible to: -optimize the development of a monitoring system for fuel-containing materials; -help in prevention of potential accidents; -recommend the use of additional safety barriers, if required; -contribute to the development of optimum lava-removal technologies; and thus -diminish material expenses and the dose burden.

**Secondly**, the development of a long-term behavior model for Chernobyl “lavas” is of interest for the whole class of hypothetical accidents accompanied with corium generation.

Similar to the Chernobyl case, works on corium removal and disposal might begin not immediately after an accident and thus would require a protracted period of time.

In such a case the model developed would make it possible to predict specific processes capable of producing changes in physical and chemical condition of corium and its degradation. The development of “lava” long-term behavior model would allow generalizing the collected experience for various corium modifications differing from each other in average fuel burnup, uranium content in material and macro- and microscopic structure.

If required, the model would allow recommending the establishment of additional safety barriers.

1.4. Novelty of “CHESS-2” Project

Unfortunately, a huge body of data on the long-term behavior of “lava” collected over 20 years of investigations at the “Shelter” has not been integrated into a single system yet. The main mechanisms of complex physico-chemical processes going on in corium after cooling and resulting in “lava” degradation have not been identified in full measure.

Early investigations on “lava” degradation conducted in 2003–2005 jointly by the Institute for Safety Problems of NPPs of the National Academy of Sciences of Ukraine and RRC “Kurchatov Institute” were mainly aimed at checking up the statements on rapid character of such a degradation, which would supposedly occur in the near future.

The fact is that in 1997 – 2002 many articles were published discussing the possibility of soon (after three to four years) and violent (during weeks) transformation of the whole of 1200 t of Chernobyl’s “lava” into submicron (!) dust under the impact of its own α-activity accompanied with “catastrophic radioecological consequences” (a quotation of the authors of such publications). A proposal was put forward to stop all transformation activities at the “Shelter” and elaborate a fundamentally new “Shelter Implementation Plan”.

Though the above hypothesis has not been proved to be true, the involved institutes have not come yet to a common conclusion on the character of long-term (> 30 years) “lava” behavior.

It is intended under “CHESS-2” Project to: -considerably deepen and extend investigations and *use both recent results achieved at the “Shelter” and the data of monitoring of “lava” samples being ~ 20 years at special storages of RRC KI, Radium Institute, etc.*

It is also proposed to generalize investigations to cover a variety of corium modifications differing from each other in average fuel burnup, uranium content in material, macro- and microscopic structure.

It is worthy of note that a proposal of the Ukrainian Research Institute of Agricultural Radiology related to the development of a model of the long-term behavior of fuel dust in the “Shelter” is being presently developed for submission to the ISTC. Thus conducting of complementary investigations under “CHЕSS-2 (Lava)” Project + the Project of Research Institute of Agricultural Radiology (Dust) is possible.

Continuous information exchange between these projects would allow expanding considerably the field of their practical application.

### 2. Expected Results and Their Application

The proposed investigations are directed towards solution of application problems.

The project results could (and should) be used at the subsequent phases of the “Shelter” transformation into an environmentally safe system.

The project results would be also of importance for elaboration of forecasts of the long-term corium behavior in corium retention devices developed for PWR-type reactors.

If needed, the model developed would allow recommending the establishment of additional safety barriers.

The results of investigations will be presented on paper and magnetic carriers, including photo-video materials etc., and will be reported at working meetings and workshops organized by RRC “Kurchatov Institute”.

2.1. Sustainability Implementation Plan

The proposed investigations are directed towards solution of application problems.

The project results could (and should) be used at the subsequent phases of the “Shelter” transformation into an environmentally safe system.

The project results would be also of importance for elaboration of forecasts of the long-term corium behavior in corium retention devices developed for PWR-type reactors.

If needed, the model developed would allow recommending the establishment of additional safety barriers.

The results of investigations will be presented on paper and magnetic carriers, including photo-video materials etc., and will be reported at working meetings and workshops organized by RRC “Kurchatov Institute”.

2.1.1. Results to be promoted

The results of the Project implementation will allow reducing financial expenses on transformation of the “Shelter” into a safe condition, i.e. will yield a profit (their use will enable diminishing the expenses on the establishment of FCM monitoring system in the “Shelter” and those of works related to nuclear fuel removal from the “Shelter”).

2.1.2. Uniqueness of results

No studies are presently known which outcomes may replace the results to be achieved during the Project implementation.

2.1.3. Demand for results

Such a demand is described in § 2.1.1.

2.1.4. Expected income

The income cannot be presently calculated for no detail designs of FCM monitoring system and of works on fuel removal from the “Shelter” have been developed yet.

2.1.5. IPR situation

All rights for information to be used in the Projects belong to the “Kurchatov Institute”. The general conditions involving IPR and stated in the Model Project Agreement will be observed.

2.1.6. Additional developments

Not intended.

2.1.7. Plan of implementation

Not intended.

2.1.8. Additional licenses or permits

Not required.

2.1.9. Business network

Not considered at the current phase.

### 3. Meeting ISTC Goals and Objectives

The project implementation will provide the following possibilities:

* for Russian scientists and specialists involved into weapons-related activities to facilitate their re-orientation towards peaceful activities;
* to help their integration into the international scientific society; and
* to support application studies in the environment protection and the nuclear safety areas.

For Collaborators of the European Union the Project will give the very first opportunity of obtaining the results of simulation of the long-term behavior of corium.

### 4. Scope of Activities

#### Task 1 Main macro- and micro- properties of Chernobyl “lavas”

|  |  |  |
| --- | --- | --- |
| **Task description and main milestones** | | **Participating Institutions** |
| The task is directed towards the collection of additional data on physico-chemical properties of the existing Chernobyl “lavas”.  Principal milestones  1. Description of **macro-properties** of Chernobyl “lavas”. A variety of types and forms (ceramics, pumice, slags, etc.) generated after corium solidification, physico-chemical properties and factors influencing their distinctions.  2. Structure and physico-chemical properties of Chernobyl “lavas” **at the micro-level** (the main matrix and types of inclusions, distribution of radioactivity between the matrix and inclusions, etc.).  Introducing necessary supplements to the database. | | 1- RRC “Kurchatov Institute” |
| **Description of deliverables** | | |
| 1 | Computational and analytical work, which results are summarized under a report including textual material and illustrations (graphics, photo and video materials); supplements are introduced into electronic database.  Due dates: 1st – 2nd quarters | |

#### Task 2 Studying external and internal factors influencing the long-term condition of different-type “lavas”

|  |  |  |
| --- | --- | --- |
| **Task description and main milestones** | | **Participating Institutions** |
| The task is directed towards examination of main factors influencing the condition of “lava” and includes the following principal milestones:  1. Examination of the effects of humidity regimes.  2. Examination of the effects of heat regimes.  3. Radiation model of “lava” taking account of both external exposure and its own radioactivity. Special attention will be focused on dose buildup in “lava” material resulting from α-decay processes.  4. Introducing supplements to the database. | | 1- RRC “Kurchatov Institute” |
| **Description of deliverables** | | |
| 1 | Computational and analytical work, which results are summarized under a report including textual material and illustrations (graphics, photo and video materials); supplements are introduced into electronic database.  Due dates: 3rd – 4th quarters | |

#### Task 3 Analysis of direct experimental investigations of the long-term behavior of different types of “lava”

|  |  |  |
| --- | --- | --- |
| **Task description and main milestones** | | **Participating Institutions** |
| The task is directed towards collection, analysis and verification of the results of experimental investigations of the long-term behavior of different types of “lava” and includes the following principal milestones:  1. Investigations at the “Shelter”  2. Generalization of the results of monitoring of “lava” samples being in laboratories and at special storages of RRC KI, Radium Institute, etc.  3. Introducing supplements to the database. | | 1- RRC “Kurchatov Institute” |
| **Description of deliverables** | | |
| 1 | Computational and analytical work, which results are summarized under a report including textual material and illustrations (graphics, photo and video materials); supplements are introduced into electronic database.  Due dates: 4th – 6th quarters | |

#### Task 4 Existing LFCM analogues and results of their investigations under long-term storage

|  |  |  |
| --- | --- | --- |
| **Task description and main milestones** | | **Participating Institutions** |
| The task is directed towards collection, analysis and verification of the results of experimental investigations of the long-term behavior of various analogues of Chernobyl “lavas” and includes the following principal milestones:  1. Collection and analysis of the data on vitrified waste  2. Identification of waste types similar to “lavas” in their properties  3. Introducing supplements to the database. | | 1- RRC “Kurchatov Institute” |
| **Description of deliverables** | | |
| 1 | Computational and analytical work, which results are summarized under a report including textual material and illustrations (graphics, photo and video materials); supplements are introduced into electronic database.  Due dates: 6th – 8th quarters | |

#### Task 5 Model of the long-term behavior of corium

|  |  |  |
| --- | --- | --- |
| **Task description and main milestones** | | **Participating Institutions** |
| The task is directed towards justification of the long-term corium behavior model and includes the following principal milestones:  1. Establishing the dependence of the dynamics of solidified corium behavior on variations in its internal composition and external conditions.  2. Using calculation, theoretical and experimental data achieved for vitrified waste to generate the corium behavior model.  3. Review of the model.  Due dates: 8th – 10th quarters. | | 1- RRC “Kurchatov Institute” |
| **Description of deliverables** | | |
| 1 | Electronic database.  Computational and analytical work, which results are summarized under a report including textual material and illustrations (graphics, photo and video materials).  Due dates: 8th – 10th quarters. | |

### 5. Role of Foreign Collaborators/Partners

The participation of foreign collaborators fulfilling the following functions is proposed:

* advising the executors on the most difficult problems during work progress;
* preliminary reviews of main technical reports under the Project and issuing the relevant recommendations; and
* holding joint workshops to trace progress in the Project implementation and discuss plans of future activities.

In addition, necessary coordination of the Project with the Ukrainian project (the Research Institute of Agricultural Radiology), the State Specialized Enterprise “Chernobyl NPP” and other Chernobyl projects will be maintained.

### 6. Technical Approach and Methodology

1.1. Supplementing the database (Tasks 1 ÷ 4)

During the Project implementation a considerable body of information will be introduced into the electronic database. Such information shall be collected, classified and assorted in compliance with the elaborated quality criteria.

E.g., the data of radiochemical analyses of FCM from the “Shelter” shall be selected by a series of parameters, such as: burnup, uranium content, cesium ratio 134Сs/137Cs, 242Cm/244Cm ratio, etc.

While applying calculated and experimental data achieved for vitrified waste, their verification shall be performed using several independent studies.

Only when all information-selection requirements are fulfilled, its analysis and the relevant calculations may be performed.

1.2. Processing of the results of survey of lava samples taken at the “Shelter” and of those stored at laboratories and special storages of RRC KI, “Radium Institute”, etc (Task 3).

The use of existing records in reports, certificates and logbooks is intended along with the results of surveys to be duly conducted and documented by executors during the Project implementation.

1.3. Working meeting with the participation of specialists representing the Institute for Safety Problems of NPPs of the National Academy of Sciences of Ukraine and the Ukrainian Research Institute for Agricultural Radiology shall be held (see Item 1).

### 7. Technical Schedule

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Quarter 1** | **Quarter 2** | **Quarter 3** | **Quarter 4** | **Quarter 5** | **Quarter 6** | **Quarter 7** | **Quarter 8** | **Quarter 9** | **Quarter 10** | **Person\*days** |
| **Task 1** |  | Workshop, report |  |  |  |  |  |  |  |  |  |
| **Person\*days** | **940** | **940** |  |  |  |  |  |  |  |  | **1880** |
| **Task 2** |  |  |  | Workshop, report |  |  |  |  |  |  |  |
| **Person\*days** |  |  | **940** | **940** |  |  |  |  |  |  | **1880** |
| **Task 3** |  |  |  |  |  | Workshop, report |  |  |  |  |  |
| **Person\*days** |  |  |  |  | **940** | **940** |  |  |  |  | **1880** |
| **Task 4** |  |  |  |  |  |  |  | Workshop, report |  |  |  |
| **Person\*days** |  |  |  |  |  |  | **940** | **940** |  |  | **1880** |
| **Task 5** |  |  |  |  |  |  |  |  |  | Final report |  |
| **Person\*days** |  |  |  |  |  |  |  |  | **940** | **915** | **1855** |
| **TOTAL** | **940** | **940** | **940** | **940** | **940** | **940** | **940** | **940** | **940** | **915** | **9375** |

\* Efforts are calculated in person-day

### 8. Personnel Commitments

#### 8.1. Individual participants

### Leading Institution: RRC “KI”

#### Category I (weapon scientific and technical personnel)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Birth**  **Year** | **Scientific Title** | **Weapon**  **Expertise Ref.** | **Function in project** | **Daily rate**  **(US$)** | **Total days** | **Total grants**  **(US$)** |
| 1. BOROVOI Alexander A. | 1938 | Full doctor in physics & mathematics | 4.9 | Project manager  (Tasks 1–5) | 35 | 550 | 19250 |
| 2. BOGATOV Sergey A. | 1958 | PhD in physics & mathematics | 4.1 | Leading expert  (Tasks 1-5) | 30 | 400 | 12000 |
| 3. BASHKIRTSEV Sergey M. | 1955 | - | 4.9 | Leading expert  (Tasks 1-5) | 30 | 550 | 16500 |
| 4. GAVRILOV Sergey L. | 1957 | - | 4.1 | Leading expert  (Tasks 1-5) | 30 | 300 | 9000 |
| 5. OREKHOV Sergey P. | 1955 | - | 4.1 | Leading expert  (Tasks 1-5) | 30 | 500 | 15000 |
| 6. STARININ Sergey K. | 1963 | - | 4.1 | Leading expert  (Tasks 1-5) | 30 | 550 | 16500 |
| 7. BORODIN Vladimir A. | 1955 | Full doctor in physics & mathematics | 4.1 | Leading expert  (Tasks 1-5) | 30 | 300 | 9000 |
| 8. KHVOSCHINSKAYA Irina K. | 1952 | - | 4.1 | Leading expert  (Tasks 1-5) | 30 | 550 | 16500 |
| 9. KHVOSCHINSKIY Valery A. | 1940 | - | 4.9 | Deputy Project manager  (Tasks 1-5) | 32 | 550 | 17600 |
| 10. IL’IN Eduard P. | 1937 | - | 4.9 | Leading expert  (Tasks 1-5) | 30 | 550 | 16500 |
| 11. PERFILOV Alexander V. | 1935 | - | 4.1 | Expert  (Tasks 1-5) | 25 | 400 | 10000 |
| 12. GOLUBEV Igor E. | 1954 | - | 4.9 | Leading expert  (Tasks 1-5) | 30 | 500 | 15000 |
| 13. OSTAPOV Evgeny L. | 1957 | - | 4.9 | Leading expert  (Tasks 1-5) | 30 | 550 | 16500 |
| **Total:** | | | | | | **6250** | **189350** |

#### Category II (other scientific and technical personnel)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Name** | **Birth**  **Year** | **Scientific Title** | **Function in project** | **Daily rate**  **(US$)** | **Total days** | **Total grants**  **(US$)** |
| 1. POLUSHINA Ludmila O. | 1945 | - | Expert  (Tasks 1-5) | 25 | 550 | 13750 |
| 2. LESLI Irina N. | 1964 | - | Expert  (Tasks 1-5) | 25 | 550 | 13750 |
| 3. FEOKTISTOVA Svetlana I. | 1942 | - | Expert  (Tasks 1-5) | 25 | 550 | 13750 |
| **Total:** | | | | | **1650** | **41250** |

#### Supporting Personnel

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Number of persons** | **Function in project** | **Daily rate**  **(US$)** | **Total days** | **Total grants**  **(US$)** |
| 1 | Translator | 25 | 400 | 10000 |
| 1 | Secretary-assistant | 20 | 550 | 11000 |
| 1 | Economist | 25 | 525 | 13125 |
| **Total:** | | | **1475** | **34125** |

#### 8.2. Managerial responsibilities

***Group of data collection Team***

**Structure:**

Leading experts

Experts

Supporting personnel

**Technical support**:

- computer machinery

**-** photo-and-video gears

***Group of data-verification Team:***

**Structure:**

Leading experts

Experts

Supporting personnel

**Technical support**:

- computer machinery

**-** photo-and-video gears

*Group of information-analysis Team:*

**Structure:**

Leading experts

Experts

Supporting personnel

**Technical support**:

- computer machinery

**-** photo-and-video gears

*Group of information-analysis Team:*

**Structure:**

Leading experts

Experts

Supporting personnel

**Technical support**:

- computer machinery

- photo-and-video gears

*Group of information-presentation Team (workshops, reports).*

**Structure:**

Leading experts

Experts

Supporting personnel

**Technical support**:

- computer machinery

**-** photo-and-video gears

**Project Manager**

**Collaborators**

### 9. Financial Information

### 9.1. Estimated Project Costs (US $)

|  |  |
| --- | --- |
| **Estimated total cost of the project** | 345000 |
| **Leading Institution** | 345000 |

#### 9.1.1. Payments to Individual Participants (US $)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Institution** | **Category I** | **Category II** | **Supporting personnel** | **Total** |
| **Leading Institution** | 189350 | 41250 | 34125 | 264725 |
| ***Subtotal:*** | | | | 264725 |

#### 9.1.2. Equipment

|  |  |  |
| --- | --- | --- |
| **Institution** | **Equipment description** | **Cost (US $)** |
| **Leading Institution** | computing machinery, photo-and-video gears | 20000 |
| ***Subtotal:*** | | 20000 |

#### 9.1.3. Materials

|  |  |  |
| --- | --- | --- |
| **Institution** | **Materials description** | **Cost (US $)** |
| **Leading Institution** | CD – DVD, USB EasyDisk Flash, expendables for office equipment, office supplies | 10000 |
| ***Subtotal:*** | | 10000 |

#### 9.1.4. Other Direct Costs

|  |  |  |
| --- | --- | --- |
| **Institution** | **Direct costs description** | **Cost (US $)** |
| **Leading Institution** | communication service, subcontracts / workshops, others | 20000 |
| ***Subtotal:*** | | 20000 |

#### 9.1.5. Travel costs (US $)

|  |  |  |  |
| --- | --- | --- | --- |
| **Institution** | **CIS travel** | **International travel** | **Total** |
| **Leading Institution** | 10000 | 10000 | 20000 |
| ***Subtotals:*** | 10000 | 10000 | 20000 |

#### 9.1.6. Overhead (US $)

|  |  |  |
| --- | --- | --- |
| **Institution** |  | **Amount** |
| **Leading Institution** |  | 10275 |
| ***Subtotal:*** | | 10275 |

### 9.2. Funding Sources

|  |  |
| --- | --- |
| **Estimated total cost of the project (US $)** | 345000 |

#### 9.2.1. Financial Sources

|  |  |  |
| --- | --- | --- |
| **Financial Source** | **Written confirmation (Y/N)** | **Amount**  **(US $)** |
| **Requested from the ISTC** |  | 345000 |
| Other financial source 1 |  | 0 |

#### 9.2.2. Non-Financial Sources

|  |  |  |  |
| --- | --- | --- | --- |
| **Source** | **Short description of contribution** | **Written confirmation (Y/N)** | **Estimated**  **amount**  **(US $)** |
| No |  |  |  |

#### 9.2.3. Submitted for Funding to Program Beside the ISTC

No

### 10. Intellectual Property Statement

The rights for intellectual property that are generated during the course of the project will be regulated by the laws of **the Russian Federation** and by the procedures, which have been developed by the ISTC.

The general conditions on Intellectual Property Rights as described in the Model Project Agreement will be observed.

### 11. Monitoring and Auditing Statement

In accordance with Article VIII of the ISTC Agreement, project recipients will give to the Center and to each Party which wholly or partly finances a project the right of access to carry out on-site monitoring and audit of all activities of the project. Project agreements will specify the portions of facilities, equipment, documentation, information, data systems, materials, supplies, personnel, and services which will concern the project and therefore will be made accessible for monitoring and audit. Project recipients shall have the right to protect those portions of facilities that are not related to the project.

### 12. Supporting Information

