PARTNER PROJECT AGREEMENT P496
(PNNL-T2-309 GE)

between

DOE's Initiative for Proliferation Prevention Program

the Science and Technology Center in Ukraine,

and

G.Eliava Institute of Bacteriophage, Microbiology and Virology
National Center for Disease Control of Georgia
National Center of Tuberculosis and Lung Diseases

Kyiv

Operative Commencement Date: _____

The Science and Technology Center in Ukraine (STCU) (hereinafter referred to as **"the Center"**),
the U.S. Department of Energy (DOE) Initiatives for Proliferation Prevention (IPP) Program (hereinafter referred to as **" the Partner"**), and
the leading Institution G.Eliava Institute of Bacteriophage, Microbiology and Virology,
the National Center for Disease Control of Georgia,
National Center of Tuberculosis and Lung Diseases,

(hereinafter referred together as **"the Recipient(s)"**)
represented for the purpose of the signature of this Partner Project Agreement (hereinafter referred to as **"the Agreement**") by their authorized representatives, (with the Center, the Partner, and the Recipient(s) hereinafter referred to collectively as **"the Signatory Parties"**),

TAKING INTO ACCOUNT THE FOLLOWING CONSIDERATIONS:

The United States of America, Canada, Sweden and Ukraine signed the agreement establishing the Science and Technology Center in Ukraine on October 25, 1993 (referred to as **"the STCU Agreement**"),

The European Union has acceded to the STCU Agreement on November 26, 1998, and in so doing, replaced Sweden as a Party to the Agreement,

Additional States may accede to the STCU Agreement to participate in the activities of the Center. Georgia acceded to the STCU Agreement on March 18, 1998; Uzbekistan acceded to the STCU Agreement on December 29, 1997, Azerbaijan acceded to the STCU Agreement on June 27, 2003, Moldova acceded to the STCU Agreement on December 7, 2004,

The Center is a legal entity and has been accredited by the Ministry of Foreign Affairs of Ukraine as an intergovernmental organization with its headquarters in Kiev,

The Partner, established under the law of the United States of America is a legal entity that has been approved by the Center's Governing Board to participate in Center activities,

The Recipient(s) is a legal entity within Georgia, ,

The Governing Board of the Center approves a project to be funded by the Partner through the Center in the domain covered by the Agreement,

The Partner has agreed to provide financial support for such project,

As set forth in the STCU Agreement, funds received by a legal entity in connection with the Center's projects shall be excluded in determining the profits of that organization for the purpose of tax liability, and funds received by persons in connection with the Center's projects shall not be included in these persons' taxable incomes,

HAVE AGREED AS FOLLOWS:

Article 1 - Scope of the Agreement

The Recipient(s) shall carry out the work plan set forth in Annex 1 according to the conditions of the Agreement, subject to the provisions of the STCU Agreement, and the Statute of the Center (hereinafter referred to as **"the STCU Statute"**) which govern in case of conflict. The activities carried out under the Agreement are entitled Bacteriophages-Based Approaches to Combat Biofilm-Forming Microbes (hereinafter referred to as **"the Project"**). The scopes of work and relevant budget lines for each recipient entity are identified in the Annex 1. All Project Activities subject to this Agreement are to be executed by the Recipient(s), using only funding provided by the Center and/or sources approved by the Center. The Recipient Entity(ies) shall notify the Center immediately if it and /or other participating institutions determine at any time to utilize any other funding sources to execute such Project activities.

Article 2 - Duration of the Project

The duration of the Agreement shall be from the date of entry into force of the Agreement (hereinafter referred to as "the Operative Commencement Date") until completion of the Agreement. Subject to the applicable requirements in Article 6 "Audit and Monitoring of the Agreement", Article 7, "Ownership and Exploitation of Results from the Agreement," and Annex III herein, the Agreement shall be deemed to have been completed upon approval by Partner of all deliverables required by the Agreement and final payment to Recipient or termination of the Agreement pursuant to Article 11 herein, whichever is earlier. The duration of the Agreement is estimated to be 24 months.

Article 3 - Financial Contribution of the Partner through the Center

3.1 The total cost of the Project to the Center shall not exceed 490000$. This total includes the cost of items described in Articles 3.2, 3.3, and 3.4 below.

3.2 The Center shall pay for items ordered by the Recipient, represented by the project manager: equipment, materials, subcontracts, other direct costs, and travel. The amount of such payments is estimated to be 124947$.

3.3 The Center shall make grant payments directly to individual participants in the Project. The amount of such payments is estimated to be 350865$. This total amount may be increased with the concurrence of the Partner and Center provided that such increase results from additional time worked on the project, rather than an increase in the rate of pay, and an offsetting reduction is made to the cost of items in article 3.2.

3.4 The Center will pay overhead to the Recipient(s), represented by its Director(s), in the amount of 2.98% of the direct project costs.

3.5 The Center will receive a fee for its service in the amount of 0% of the total project costs. This amount should be calculated in addition to the total cost of the project.

3.6 The Partner will deposit to Center's account funding for first year of the project in accordance with Article 7 of Annex 2. Project funds will be sent annually contingent upon a positive review of the project progress by the Partner. The entire amount of Partner's commitment is equal to 490000$ that is the total cost of the project plus STCU's fee in accordance with Articles 3.1 and 3.5.

3.7 Within Ukraine, all cash payments will be made in the national currency of Ukraine. Conversion of US dollars to the national currency of Ukraine will be according to the exchange rate of the Interbank Rate of Ukraine. Within Georgia, Uzbekistan, Azerbaijan, and Moldova all cash payments will be made in U.S. Dollars or Euros where possible.

3.8 Title to the property purchased for performance of this Agreement in accordance with Article 3.2 shall be determined in Annex 1 by applying one of the following clauses:

3.8.1 title will vest in the participation institution at the time of delivery or

3.8.2 title will remain with the Center until termination or completion of the project, at which time title will be vested in accordance with Article 8 - Special Conditions or following to additional agreement between the STCU, Partner and Recipient(s) replacing Special Conditions.

3.9 Title to any goods (deliverables) purchased by Partner under this Agreement shall pass directly from Recipient to Partner at the time of delivery, subject to Partner's right of rejection upon inspection.

Article 4 - Cost Statements, Reports, and other Project Outputs

Quarterly cost statements shall be submitted by the Recipient to the Center. The quarterly cost statements will include a representation that all projects activities conducted by the Recipient during the preceding quarter were funded only with funding provided by the Center and that no other source of funding was utilized in carrying out such activities.

Quarterly progress reports shall be submitted by the Recipient to the Center, to the Partner and/or to the Technical Monitor as designated by the Partner and identified in Annex I - Work Plan (in English and Ukrainian (optional) or Russian (optional, if the project is located only in other CIS states)), in hard copy and in electronic format in accordance with Annex 3 - Reports. The format of the cost statements and quarterly progress reports will be provided by the Center.

Technical reports and other deliverables that are requested by the Partner shall be submitted by the Recipient to the Partner and/or Technical Monitor in accordance with Annex I and Annex III.

Article 5 - Confidentiality

5.1 All reports or portions of reports properly marked as invention information or Business Confidential Information by the Recipient in consultation with the Partner shall be protected from public dissemination unless otherwise agreed by the Recipient(s) and the Partner.

5.2 Subject to any obligations under this Agreement and in accordance with applicable laws and regulations, the Signatory Parties agree to keep confidential any invention information or Business Confidential Information communicated to them by other Signatory Parties or third parties in relation to the execution of this Agreement, unless such information so disclosed is or becomes legitimately available to the receiving Signatory Party through other sources without any covenant as regards its confidentiality.

Article 6 - Auditing and Monitoring

6.1 Access by the Center and the Partner, through the Center, to the project site to carry out on-site monitoring and for the evaluation and the verification of the progress of the Project activities, and to do audits of costs shall be granted by the Recipient(s) including access to (a) portions of facilities where the Project is being carried out and to all equipment, documentation, information, data systems, materials, supplies, personnel, and services which concern the Project, and (b) technical and cost information concerning the management and progress of the Project.

6.2 The Center will give the Recipient(s) up to 10 days advance notice of any intended on-site monitoring of the project.

6.3 The Recipient(s) has the right to protect those portions of facilities that are not related to the Project.

6.4 All documentation and records, including those associated with equipment, data systems, materials, supplies, and services utilized on the project must be maintained and made available for review by the Center, the Partner, or their representatives, for up to two years following the project's completion or termination.

Article 7 - Ownership and Exploitation of Results

7.1 The allocation of intellectual property arising from this Agreement and the responsibilities for protecting and exploiting such intellectual property should be established between the Recipient(s), the Partner and/or Technical Monitor, on behalf of the Partner, in the form of Annex 4.

7.2 Exploitation of results shall be limited to applications for peaceful purposes. In this regard, the Recipient(s) and the Partner shall ensure that any results which could result in concerns over proliferation of weapons technology and transfer of sensitive technologies will be protected in accordance with relevant laws of Georgia, and international agreements and conventions to which Georgia, is a party.

Article 8 - Special Conditions

8.1 The special conditions specified in this Article shall prevail over other conditions specified in the Agreement.

8.2 Partner, upon agreement with Center and Recipient(s), may at any time, by written notice, make changes within the scope of this Agreement. If any such change causes an increase or decrease in the cost of, or the time required for, performance of any part of the work under this Agreement, whether or not changed by the order, or otherwise affects any other terms and conditions of this Agreement, Partner shall make an equitable adjustment in the Project Price, the delivery schedule, or both, and shall modify the Agreement.

Article 9 - Liability

9.1 The Signatory Parties accept the project team for the execution of the project and accept the project manager as the leader of the project team. The project manager shall be responsible for scientific, technical, personnel and financial activities related to the project, and shall have exclusive rights to handle all goods and services related to the project during its term. The director(s) of the institution(s) is liable for provision of general administrative and legal support to the project manager in connection with the execution of the Agreement.

9.2 The Center shall not be liable for nonperformance by the Partner or the Recipient(s) of their obligations under the Agreement.

9.3 The Center and Partner shall not be liable for any material loss, damage, or injury of any nature arising from, or in connection with, the performance of the work under the Agreement.

Article 10 - Disputes

Disputes arising during performance of the Agreement including, in particular, (1) a claim by the Recipient(s) for any payments deemed due; (2) an interpretation of a provision of the Agreement; or (3) a request for relief or approval related to the Agreement, shall be subject to the following procedure.

The Recipient(s) shall submit any claim, demand, or request in writing to the Partner and to the Center. The Partner and the Center will prepare a joint response. The written decision of the Partner and the Center shall be delivered to the Recipient within four weeks of the receipt of the submission.

Exceptionally, the Recipient(s) may appeal the Partner's and Center's decision in writing through the Executive Director of the Center to the Governing Board of the Center within four weeks of the communication of the Partner's and Center's decision.

The decision of the Governing Board shall be final and binding (unless otherwise provided). Pending the final settlement of disputes, the Recipient(s) shall, nevertheless, proceed diligently with the performance of the Agreement.

Article 11 - Suspension and Termination of the Agreement

11.1 Each Signatory Party shall reserve the right to suspend the Project or its part by issuing to the other Signatory Parties a notification of suspension which specifies the problem, the effective date, and the period of the suspension.

11.2 When the Project is suspended by the Center, and the period of the suspension expires and the Center and the Recipient are unable to find a solution, the Center shall, in consultation with the Partner, terminate the Project or a part of the Project.

11.3 When the Project is suspended by the Recipient, and the period of the suspension which is specified in the Recipient's notification expires and the Recipient and the Center are unable to find a solution, the Recipient shall terminate the Project.

11.4 Notwithstanding the termination, the Recipient shall submit reports and cost statements covering the period up to the termination and the following provisions of the Agreement shall continue to apply: Article 10, and Annex 2.

11.5 When Force Majeure situations occur which make the Project implementation impossible, the Center in consultation with the Partner and the Recipient(s) may terminate the Project with application of similar procedures as specified above.

11.6 When the Recipient(s) has committed actions, which obviously violate the national laws of Georgia, or which obviously are contrary to the objectives specified under the STCU Agreement, the Center shall terminate the Project with immediate effectiveness upon written notification of termination to the Recipient. In this case, the Recipient(s) shall promptly return to the Center all payments and goods previously provided to the Recipient(s).

Article 12 - Amendments, Variations, or Additions

The provisions of the Agreement and its annexes may be amended or supplemented by means of a written agreement signed by authorized representatives of the Signatory Parties. However, operational changes in Annex 1, other than changes in the project manager, the institution, and the overall schedule, can be made by agreement between the Center and the Recipient(s) upon approval by Partner requested in accordance with applicable clauses of Annex 1.

Article 13 - Annexes

The Annexes are an integral part of the Agreement. They are:
Annex 1 - Work Plan
Annex 2 - Financial Provisions
Annex 3 – Reports
Annex 4 – Intellectual Property

Article 14 - Entry into Force of the Agreement

The Agreement shall enter into force on the first of the month following the date this Agreement is signed by the last signature of Signatory Parties or the date Partner deposited its commitment in accordance with Article 3.6 to Center's account, whichever is later, i.e. on "the Operative Commencement Date".

Prepared in Kyiv in the English and Ukrainian languages (Russian optional, if the project is located only in other CIS State). In the event of inconsistencies between the English and other texts, the English text shall take precedence.

For the Center

_____
Date of Signing (REQUIRED):

Andrew Hood
Executive Director
Science and Technology Center in Ukraine
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Tel/Fax: +380(44) 490-7150/45

For the Partner

_____
Date of Signing (REQUIRED):

Regina Carter
Director
Global Initiatives for Proliferation Prevention
Office of Global Security Engagement and Cooperation
National Nuclear Security Administration
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For the Recipient(s)

_____
Date of Signing (REQUIRED):

Tarasi Gabisonia
Project manager

Approved_____
Revaz Adamia
Director
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_____
Date of signing(REQUIRED):
Gela Mgeladze
Project Manager

Approved _____
Nato Avaliani
Director
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_____
Date of signing(REQUIRED):
Sergo Vashakidze
Project Manager

Approved _____
Iagor Kalandadze
Director
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Tel: +995.99 236553 Fax: +995.32 910251

Annex I - Work Plan

1. Project Title P496
Bacteriophages-Based Approaches to Combat Biofilm-Forming Microbes

2. Project management

2.1 Project Manager:

Name: Gabisonia Tarasi Givi (Professor)
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2.2 Name of leading institution/address:

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2.3 Name of participating institution(s)/addresses:

Name: National Center for Disease Control of Georgia
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2.3.1 Participating institution Manager:

Name: Mgeladze Gela Luri (PhD)
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Institution: National Center for Disease Control of Georgia
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Name: Vashakidze Sergo Alexander (Doctor)
Title: Surgery Coordinator
Institution: National Center of Tuberculosis and Lung Diseases
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2.4 Technical Monitor (partner's designee to oversee project progress, review project reports and other deliverables):

Institution: Pacific Northwest National Laboratory
Name: Evguenia Rainina
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3. Introduction and Overview

Although the spread of antibiotic resistance has long been known as a worldwide phenomenon and has been highly publicized, ubiquitous ability of some bacteria to form biofilms has received far less attention. Bacterial biofilm is a structured community of bacterial cells enclosed in a self-produced polymeric matrix and adherent to an inert or living surface, which constitutes a protected mode of growth that allows survival in hostile environment. The biofilm-forming microorganisms, biofoulers, have been shown to elicit specific mechanisms for initial attachment to a surface, formation of microcolony leading to development of three-dimensional structure of mature biofilm. They differ from their free-living counterparts in their growth rate, composition and increased resistance to biocides. This makes them highly difficult to eradicate with therapeutic doses of antimicrobial agents (1).

Biofouling “Superbugs” have risen into the public’s consciousness over the past decade, because these bacteria cause a great deal of harm across the developed world—in clinical settings, the general community, and industry, with associated costs upwards of $21B per year (2). The rise of these superbugs has been called one of the world's most pressing public health problems (*3*). The bacteria living in a biofilm are the cause for constant biofouling and biocorrosion in industry costing $15B annually, while they lead to persistent contamination in heating, ventilation, and air conditioning (HVAC) systems, water systems, and habitable structures that ultimately lead to persistent infections in patients exposed to them. The emergence of difficult-to-eradicate bacteria has prompted scientists, developers, and clinicians to revisit all currently used approaches to antimicrobial solutions, such as combination of disinfectants for treating piping and surfaces, cycling of disinfectants, and combining of physical and chemical methods.

To combat bacteria living and spreading in biofilms, this project aims to develop new bacteriophage-based approach for two bacteria, *Pseudomonas aeruginosa* and *Legionella* pneumophila that cause significant biofouling and outbreaks in hospitals, hotels, and other large, inhabited structures. These bacteria also acquired multidrug resistance, which makes them exceedingly hard to eradicate (*4*). Bacteriophage-based approaches represent a completely novel class of antimicrobial treatments. Leveraging the biological diversity of bacteriophages, and combining it with the rational engineering to impart novel, biofilm-degrading functionality to them allows these new agents to be brought to bear in the fight against increasingly antibiotic-resistant, biofilm-protected bacteria. If successful with these first two bacterial targets, the results of the project could be extrapolated and applied to all common fouling and pathogenic bacteria.

What’s the objective

The objectives of the project will be focused on isolation and characterization of novel bacteriophages of *L. pneumophila* and *P. aeruginosa* for the engineering of effective industrial and clinical preparations against these two causative agents of community and hospital-acquired pneumonia (CAP and HAP). The overarching goals of the project are a development of bacteriophage-based preparations capable of eradication of biofilms, including biofouling bacteria population and their protective shelters and examine this preparation in the hospital setting.

What’s the problem

Drug resistance in bacteria is increasing and the pace at which new antibiotics are being produced is slowing. It is now almost commonplace to hear about methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant *Enterococci*, multi-drug resistance in *Mycobacterium tuberculosis* strains and multi-drug-resistant Gram-negative bacteria. So-called new and emerging pathogens add to the gravity of the situation. Reduced susceptibility to biocides is also apparently increasing. A particular problem, however, is found with bacteria and other microorganisms present in biofilms, where a variety of factors can contribute to greater insusceptibility compared

with cells in planktonic culture. Also of potential concern is the possibility that widespread usage of biocides is responsible for the selection and maintenance of antibiotic-resistant bacteria.

Two bacteria that cause significant biofouling and outbreaks in hospitals, hotels, and other large, inhabited structures are *P. aeruginosa* and *L. pneumophila.* Both species are recognized for their ability to form biofilms, while also having acquired multidrug resistance, which makes them exceedingly hard to eradicate (*4*).

The bacterium *L. pneumophila* was first identified in 1977 as the causative agent of Legionnaire's Disease (LD) (*5*). It has since been associated with outbreaks linked to poorly maintained artificial water systems, particularly cooling towers or evaporative condensers associated with air conditioning and industrial cooling, hot/cold water systems in public and private buildings, and whirlpool spas (*4, 6-8)*. In addition to epidemiological characterizations of outbreaks of *Legionella*, pneumonia caused by *L. pneumophila* is also grouped in with CAPs. CAPs are one of the most commonly diagnosed infectious diseases in North America, are a cause of significant morbidity and mortality, and proper treatment depends on targeting antibiotic therapy towards the responsible pathogen. In 50% of cases, however, the specific pathogen cannot be detected (*9*). According to the Centers for Disease Control and Prevention (CDC), between 8,000 and 18,000 people are hospitalized with Legionnaires' disease in the United States each year. To illustrate the point that *Legionella* contamination is not an isolated issue of HVAC systems in large hospitals but a global problem, one only needs to look to the 18 cases of community-acquired Legionnaires' disease from June to November 2005 that were reported in Rapid City, South Dakota, as well as on the data generated in Tbilisi, Republic of Georgia. The outbreak in South Dakota was caused by *L. pneumophila* contaminated a small decorative fountain in Restaurant (*10*). Contrasting the South Dakota cases now are the monitoring studies of the Republic of Georgia half a world away, where legionellosis has been monitored since 1987. Three clinical forms of legionellosis in Georgia are recorded—pneumonic, non-pneumonic, and a fever with skin eruption. Diseases are diagnosed among all age groups, from infants to seniors of more than 70 years of age. In the capital of Georgia—Tbilisi—99 sick people were diagnosed with legionellosis among workers of two production facilities. The water in the air-conditioning system at those production facilities was infected with *Legionella*. The case fatality rate may be as high as 40% to 80% in untreated, immune-suppressed patients, but can be reduced to 5% to 30% through appropriate case management. Although *L. pneumophila* is susceptible to certain antibiotics, or at least to a combination of a few antibiotics, treatment requires very high intracellular concentrations. These combinations of antibiotics and the high dosage in which they are used leads to a greater chance of evolving an antibiotic-resistant *Legionella* species.

P. aeruginosa is an obligate aerobic Gram-negative rod and can be found in many different environments such as soil, water, and plant and animal tissues. *P. aeruginosa* has become increasingly recognized as an emerging opportunistic pathogen of clinical relevance as causative agent of nosocomial pneumonia associated with a high morbidity and mortality rate. Several different epidemiological studies track its occurrence as a nosocomial pathogen and indicate that antibiotic resistance is increasing in clinical isolates (*11*). According to the CDC, the overall incidence of *P. aeruginosa* infections in U.S. hospitals averages about 0.4% (4 per 1000 discharges), and the bacterium is the fourth most commonly isolated nosocomial pathogen accounting for 10.1% of all hospital-acquired infections. A danger of *P. aeruginosa* is its resistant to high concentrations of salts, most antiseptics and disinfectants, and many commonly used antibiotics (1*2*). *P. aeruginosa* is the most prevalent chronic infection contributing to the pathogenesis of cystic fibrosis. Furthermore, it is the leading etiological agent causing pneumonia in patients with artificial airways such as intubated patients or those that received a tracheostomectomy and has the highest associated mortality (*13*). In the Republic of Georgia, an epidemiologic and molecular investigation of endemic *P. aeruginosa* infection in an intensive care unit (ICU) of the National Medical Center (NMC) yielded a collection of strains from the 2005–2007 period stored by the NCDC. Endemic *P. aeruginosa* was reported as the most predominant etiological factor responsible for HAP in the NMC ICU. The antimicrobial susceptibility of the isolates demonstrated it resistant to multiple antibiotics such as, cefepime, ciprofloxacin, etc. Problematic is also the occurrence of these MDR strains, because they were common in making up 28/89 (31.5%) of all *P. aeruginosa* isolates in this study. The incidence rate of MDR *P. aeruginosa* infection was 15.8/100 patient admissions per year. Furthermore, there was an outbreak of HAP-caused *P. aeruginosa* in March–August 2006, during which isolates from 25 patients were taken, typed, and found to be MDR. Environmental investigations demonstrated the presence of *P. aeruginosa* in the ventilation equipment. In one case, MDR *P. aeruginosa* was found even in the microfilter of an atrioventricular machine. This corroborates a previous study conducted in 1997 by the American International Health Alliance (AIHA) addressing the spread of hospital infections; *P. aeruginosa* was among the most frequent isolates reported (*14*). *P. aeruginosa* is a large factor in hospital-acquired—nosocomial—infections and it is rapidly becoming more and more resistant to antibiotics.

What are other people doing

Reduced microbial susceptibility to biocides is apparently increasing. Therefore, there is a continuous search for new disinfecting strategies, disinfecting chemicals, and natural substances. Rotation of disinfecting chemicals in the hospitals became a routine (15).

To control *Legionella* and *Pseudomonas*, physical and chemical approaches are often applied in combinations;

however, its proven effectiveness varies and practically all known methods have mild to high environmental impact. The heat & flush method involves heating water temperature to as high as 160F for up to 30 minutes to sterilize systems. This chemical- free method requires no additional equipment and is commonly used, particularly in hospital outbreak scenarios. However, it is labor intensive and can prove ineffective for long-term *Legionella* infestation management. It also can damage older pipes and create potential for scalding. It was demonstrated that the first disinfection eliminated *Legionella* spores from patient wards and reduced the colonization rate in ICUs from 80% to 25%. However on retesting two months later, colonization in patient wards had increased from 0% to 15% of the distal sites, and to 93% of distal sites in the ICUs (16).

The Shock or Hyper Chlorination disinfection method involves injecting chlorine into the water distribution system. A concern with this method is that chlorine decomposes rapidly at elevated water temperatures, and *Legionella* re-colonization can occur in as little as one to two weeks during continuous chlorination following the shock. The method also has proven highly corrosive to plumbing, which can be offset in part with silicate corrosion control. In addition, exposure to the chlorine byproduct Trihalomethane is linked to several types of cancer, creating risk for facility employees handling stored chemicals or implementing disinfection (17).

Chlorine dioxide (CIO2) is approved by the US Environmental Protection Agency (EPA) for use as a potable water disinfectant and has successfully been used for many years in Europe. While the methods of production vary, most involve the use of an acid and chlorite donor. CIO2 is a powerful oxidant and kills *Legionella* and other bacteria through the oxidative disruption of cellular processes. However, CIO2 is corrosive to plumbing infrastructure and creates byproducts including chlorate and chlorite.

Copper-Silver Ionization is he most recent advance in the fight against *Legionella.* This disinfection method dissolves and distributes small amounts of copper and silver ions throughout water systems to eradicate bacteria. Installation and permanent maintenance of a continuous eradication metallic ion unit is required to achieve reliable *Legionella* control. Although this significantly increases hospital utilities cost, it appears to be the most effective methodology known for today (18).

Additionally, UV light, ultrasound, cold plasma, and ozone are applied, to eradicate *Legionella* and *Pseudomonas* in laboratory conditions and in some hospital scenarios; however the application of these methods represent a significant challenge for implementation in real world conditions due to environmental impact, cost and reliability (19).

P. aeruginosa colonizes various surfaces, including medicinal re-usable instrumentation, found in water, and known for colonizing skin. Disinfectants efficacy toward *P. aeruginosa* varies, and the combination and rotation of disinfectants are strongly recommended to prevent this superbug spread. There are a few general classes of disinfectants, which are more or less successfully applied to control *P. aeruginosa* outbreaks in the hospitals, nursing homes, and other health care facilities: 1) Oxidizing agents, such as various acids (e.g. phosphoric, hydrochloric, citric, and peroxyacetic); chlorites and hypochlorite; hydrogen peroxide; halogens (chlorine and iodine); 2) Surface-active agents such as the disinfectants containing quaternary ammonia. They are cationic detergents with strong surface activity. They are acceptable for general-use disinfectants and are active against Gram-positive. However, because these compounds retain the disinfecting activity for a long time its application requires post-cleaning efforts to avoid negative post-treatment effect to environment and humans. 3) Protein-denaturing agents include alcohols, aldehydes, and etc. These compounds are quite volatile chemicals, and it explains its high penetrating ability; however, its high volatility causes serious respiration effect and because of this, such compounds are considered as potentially harmful for humans during applications, require special protection during application and post-application clean up. Additionally to chemical disinfecting approaches, UV light, dry and wet sterilization, treatment with cold plasma, and ultrasound are widely in use to control *P. aeruginosa*; however, often with minimal efficacy.

One highly desirable option for dealing with bacterial contamination and colonization is to use bacteriophages as antimicrobial agents, a concept first conceived in 1917 by Felix d'Herelle (*20*). Phages replicate and multiply only in the presence of bacteria as their host, and lose viability in their absence, which makes them ideal as disinfecting agents on surfaces, as well as antimicrobials for human applications. Phages have been used since their discovery in the early 20th century, but only now are modern genetic engineering and biotechnological practices being combined with the versatility and diversity of bacteriophages to unlock the power that bacteriophages hold for these applications. Phages have been used as antimicrobial agents to fight bacterial infections in humans and in animals, or to treat crops and other farm products (*21*,*22*). In recent years it has been recognized that phages also have several potential applications in the modern biotechnology industry: they have been proposed as delivery vehicles for protein and DNA vaccines (*23*); and as tools for screening libraries of proteins, peptides, or antibodies (*25*). These diverse capabilities, along with the ease with which their genomes can be genetically manipulated and established culture production methods predispose phages to be platforms for development (24).

To date, very little use has been made of bacteriophages for eradication of biofilm-forming pathogens. One main problem exists that precludes the use of bacteriophages for biofouling microbes' decontamination: bacterial

biofilms effectively block bacteriophages from penetrating into the deeper layers of the film and killing the resident bacteria.

In this regard, proposed study will be one of the very first attempts to exploit bacteriophages as decontaminating means.

References

1. B. Prakash et al, Curr. Sci., 85 (2003).
2. G. Taubes, *Science* **321** (2008).
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What are we going to do

In spite of significantly increased interests in bacteriophages during the last 15 years, it is apparent that the capability of bacteriophages has not been fully exploited either in medicine as an additives/alternative to antibiotics, for eradication of pathogens causing various diseases in environmental settings, or for decontamination of microbial species causing pipelines corrosion, etc. Project scope will include an isolation, characterization, and development of bacteriophage platforms displaying tropism for *L. pneumophila* and *P. aeruginosa.* These isolated bacteriophages will serve as background strains for the engineering of effective industrial and clinical preparations against these two causative agents of CAP and HAP. The research will include but will not be limited to: 1) Isolation of bacteriophages against *L. pneumophila* and *P. aeruginosa* and screening of non-characterized bacteriophages in collaboration partners' repositories against reference *L. pneumophila* and *P. aeruginosa* bacteria in order to select phages possesses the highest lytic potential; 2) *de novo* isolation and characterization of *P. aeruginosa* and *L. pneumophila* strains from natural and hospital sources; 3) *de novo* isolation and characterization of *P. aeruginosa* and *L .pneumophila* bacteriophages from natural and hospital sources, 4) engineering of the phages capable of destruction of 3-dimentional biofilms and killing microbes sheltered in there. Bacteriophages capable of killing two biofilm-forming environmental/nosocomial pathogens, *P. aeruginosa* and *L. .pneumophila* will result the project. Should the approach implemented in this project resulted in effective phages destroying biofouling microorganisms, similar approach could be used to develop phage-based preparations for the other biofouling microorganisms such as causing pipelines corrosion, etc.

What's new

The approach based on genetically engineered bacteriophages possessing hydrolytic activity represents a novel class of antimicrobial treatments (24). Leveraging the biological diversity of bacteriophages, and combining it with the rational engineering to impart novel, biofilm-degrading functionality to them allows these new agents to be brought to bear in the fight against increasingly antibiotic-resistant, biofilm-protected bacteria. Should the project be

a success, new phage-based preparation would be widely applicable in hospital settings, hotels, cruse ships, etc to eradicate biofouling microbes by environmentally and health friendly methodology.

Who we are

G. Eliava Institute of Bacteriophages, Microbiology, and Virology

IBMV (http://www.eliava-institute.org/), a world-known institution working in the field of Applied Microbiology, Virology and Infectious Immunology, is currently operating under authority of the Ministry of Science and Education of Georgia. The main direction of the institute since its establishment in the early 1920s remains the study of bacteriophages and phage therapy.. IBMV scientists have years of experience in the study of bacterial pathogens and the use of bacteriophages for treatment and prevention of infections. A substantial number of different bacterial pathogens (*Staphylococci, Streptococci, E. coli, Salmonella, Shigella, Pseudomonas, Acinetobacter, Enterococci, Xanthomonas, Proteus, Pasteurella*) and corresponding bacteriophages have been accumulated through the years at IBMV depository. Since 2003, the Eliava Institute has been involved in the Georgian-American Program "Biological Weapon Proliferation Prevention" (BWPP), which aims to consolidate and secure the most dangerous pathogens, by detecting, investigating, and producing different biological preparations against them. Over the past 8 to 10 years, various international and national programs have sponsored research at IBMV. The proposed project participants took part in several joint research projects: CRDF (2- 2194), ISTC (G-595) , BTEP (G-587, G-1009), STCU (Gr-130, 3387, P395), GNSF (3311) and GNSF (8-036, 8-270) The projects performed the isolation, identification, and study of human, animal, and plant pathogens, and their corresponding bacteriophages. IBMV scientists invented a considerable number of therapeutic drugs, such as SES-phages, FERSIS-phages, and ENCO-phages. Eliava Foundation, a not-for-profit organization, was established in 2008 to manage intellectual property rights at the IBMV. A spin-off company, Eliava Production, also had been established to transfer the science to technology at Eliava. IBMV's particular contribution to this project will be a selection of candidate bacteriophages, including phage screening and isolation of new bacteriophages and phage characterization. In addition, IBMV will generally assist its Georgian partners in phage research and in the in development of the protocols for validation of phages efficacy against specified biofilm-forming microbes and for environmental eradication of these biofilm-forming species in hospital settings.

IBMV project participants

1. T. Gabisonia Sc.D. Professor - project manager; will take overall responsibility for the project, including project performance, scheduler, and reporting. He will also consult and assist scientists in selection of phages, and will take part in IP protection and manuscripts preparation.
2. Loladze Manana, PhD - group leader; experimental biochemist, microbiologist and molecular biologist. She will supervise laboratory work, consult and train the scientists; will take part in PFGE –based molecular characterization of bacteriophages (restriction analysis, genome sequencing), and bioinformatics analysis; discuss the results and take part in reporting and manuscripts preparation.
3. Chanishvili Lamara, MS - experimental microbiologist; will assist in selection of bacteriophages
4. Nadiradze Manana, PhD - experimental microbiologist; will perform isolation and characterization of *P. aeruginosa* phages
5. Chakhunashvili Natalya, PhD - experimental microbiologist; will take part in isolation of *L. pneumophila* phages
6. Tsitsino Turmanidze, PhD- experimental biochemist and microbiologist; will study biological characteristics of selected bacteriophages, such as adsorption, latent period, lytic activity, and stability.
7. Maia Alibegashvili, MS - experimental biochemist and microbiologist; will conduct molecular characterization of selected candidate bacteriophages.
8. Marine Giorgadze, MS - experimental microbiologist; will take part in selection of bacteriophages effective against *P. aeruginosa* and *L. pneumophila*.
9. Didebulidze Kakha PhD - experimental microbiologist; will investigate morphological and biological characteristics of selected bacteriophages, such as adsorption, latent period lytic activity, and stability.
10. Melashvili George, PhD - experimental microbiologist; will participate in selection of bacteriophages effective against P. *aeruginosa* and *L. pneumophila*.
11. Irina Pataridze, MS - experimental biochemist and microbiologist; will take part in molecular characteristics of bacteriophages.
12. Ketevan Kochlamazashvili PhD - experimental microbiologist, will participate in isolation of bacteriophages against *L. pneumophila* .

IBMV Selected publications

1. L. Minakhin et al. Genome sequence and gene expression of *B. anthraces* bacteriophage Fah. J. Mol Biol. 354(1), 2005

2. D. Savalia et al. Genomic and proteomic analysis of phiEco32, a novel *E. coli* bacteriophage. J. Mol Biol. 377(3), 2008
3. T. Gabisonia et al. Phage sensitivity of multi resistant strains of *S. aureus, S. agalactiae and S. pyogenes,* which were isolated from caws during mastitis. Proc Georgian Ac Sci., Biol. Ser, 31(4), 2005.
4. T.Gabisonia et al. Spreading of R-plasmids in strains of *Staphylococcus,* which were isolated during endometritis. Proc Georgian Ac. Sci. Biol. Ser. 31(5), 2005.
5. M. Loladze et al. Use of bilidase for the treatment of experimental hypertrophic postburn cicatrices. Bull Exp. Biol. Med, 139(1), 2005.
6. T. Gabisonia et al. Activity of antibiotics against nosocomial *Acinetobacter* isolated from clinics of Tbilisi. Proc Georgian Ac Sci. Biol. Ser 35(5-6), 2009.
7. K. Kochlamazashvili et al. Biological peculiarity and antibiotic sensitivity of *Staphylococcus* strains isolated during surgical infections in animals. Proc Georgian Ac Sci., Biol. Ser 31(4), 2005

National Center for Disease Control and Public Health of Georgia

The NCDC (http://www.ncdc.ge) was founded in 1996 on the basis of Georgian Center for Plague Control that was supervised by the Ministry of Health in the Soviet Union. Currently, NCDC is an integral part of the Georgian Public Health system. NCDC's employs 300 specialists from which about 15% received long- and short-term training in leading western institutions. The research activity in NCDC is very diversified and includes molecular biology, bacteriology, tissue culture–based research and diagnostics, molecular epidemiology, and nosocomial, diphtheria, and other respiratory infection studies. Of greatest value to this project is the National Collection of Bacteria and Viruses, which is operated by the NCDC. Many clinical isolates of *P. aeruginosa* and four species of *L. pneumophila* isolated during Legionaries' disease outbreak in Tbilisi have been deposited in this collection and will be made available for this project. In addition, there are several other departments that could be useful for collaboration in this project, including the Nosocomial Infections Department; High-Risk Pathogens Department, Epidemiological Investigation and Outbreak Control Department, and others. The NCDC is fully equipped with modern, sophisticated research and telecommunication equipment, and connected to the high-speed data backbone of Georgia. NCDC BSL2 Lab space will be accessible for the project performance if necessary. The NCDC has a strong track record in successful collaboration with out-of-country partners as is evident by the large number of projects conducted at the NCDC and sponsored by various U.S. agencies, private investors, the Global Fund, the World Health Organization (WHO), the Government of France, and other agencies and governmental institutions. The proposed project participants took part in several joint research projects: STCU (P-142a), BTEP / ISTC (G-597p, #119 / G-1462, G-1081); CBR GG-1, 17, 18/CRDF (GEB2-1953 TB-05, GEB2-1962-TB-08, GEB2-1964-TB-09).

NCDC project participants

1. Mgeladze Gela, PhD- NCDC co-Manager; experimental microbiologist; will oversee project performance at NCDC and will coordinate project performance and scheduler with Project manger; contribute to reporting, IP protection and manuscripts preparation.
2. Katsitadze Guram Sc.D – group leader; experimental microbiologist/epidemiologist; will tke part in new *Legionella* strains isolation and characterization.
3. Tsertsvadze Nikoloz, PhD - experimental microbiologist/epidemiologist; will take part in *Legionella* isolation and characterization.
4. Tsanava Shota, PhD - experimental microbiologist/epidemiologist; research with *Legionella* strains from repository and isolation and characterization of new strains.
5. Imnadze Paata PhD - leading expert; microbiologist/epidemiologist; will examine an efficacy of engineered bacteriophages.
6. Grdzelidze Marina, MS – experimental microbiologist; basic characterization of available collection of *Legionella* strains.
7. Mirianashvili Zurab - experimental microbiologist; isolation and morphology study, biochemical, and serological characterization of *Legionella* strains.
8. Chubinidze Svetlana - experimental microbiologist; isolation and morphology study, biochemical and serological characterization of *Legionella* strains.
9. Chanturia Gvantsa - experimental microbiologist and molecular biologist; PFGE- genotyping of *Legionella* strains, and bioinformatics analysis.
10. Datukishvil Sophio - experimental microbiologist; isolation and morphology; biochemical and serological characterization of *Legionella* strains
11. Khmaladze Ekaterine - experimental microbiologist and molecular biologist; PFGE- genotyping of *Legionella* strains, and bioinformatics analysis.
12. Kometiani Tevdore – IT specialist, information and IT support.

NCDC Selected publications

1. L.Sakvarelidze, et al. Cases of Legionellosis in Tbilisi. J. Microbiol. Epidemiol. Immunol, 1, 1990.
2. P. Imnadze et al. Anthrax in Southern Caucasus. Antibiotica Monitor, XVIII (1/2), 2002.
3. D. Tsereteli et al. Plague in Southern Caucasus. Antibiotica Monitor, XVIII (1/2), 2002.
4. A. Sulakvelidze et al. Salmonellosis in the Republic of Georgia: using molecular typing to identify the outbreak – causing strain. EID, 6(70), 2000.
5. G. Katsitadze et al. Peculiarities of quantitative and qualitative indices of intestinal microflora in children of refugees from Abkhazia. Sakartvelos Samedicino Moambe, 3, 2003.
6. G.Mgeladze et al. Detections of *Y. enterocolitica* strains isolated from the rodents and other ecosystems. Materials of the Scientific Conference on the 50 Anniversary of the Georgian Station for the Plague Control, 1988.
7. T. Revazishvili et al. Genetic background and antibiotic resistance of *S. aureus* strains Isolated in the Republic of Georgia. JCM, 44(10), 2006.
8. L. Beridze et al. Characteristics of natural foci of plague existing on the territory of Georgia. Saqartvelos Samedicino Moambe, 2, 2004.

National Center of Tuberculosis and Lung Diseases

The National Center of Tuberculosis and Lung Diseases (NCTLD; http://www.tbgeo.ge) is a non-profit organization that was founded in 2001. NCTDL combined the Institute of Tuberculosis and Lung Diseases, the city TB Hospital, and the Georgian Railway TB-Hospital. It is the main facility for TB control and lung diseases in Georgia that creates, implements, and administers the National Tuberculosis Program following WHO recommendations. NCTLD employs highly professional staff with medical licenses and adequate certificates. In addition to its leading role in TB diagnosis, prophylaxis, and treatment, NTCLD supports research in lung diseases caused by different pathogens often acquired by patients at the hospital settings, such as pneumonia. The proposed project participants took part in several joint research projects: CRDF (GEX1-2711-TB-06, GEX1-2712-TB-06, GEXO-1059-TB-04, GEB1-002725-TB-07, GEB2-2605-TB-04, GN1-432, GB2-2012); BTEP/ISTC (A-998p, G-610p)

CAP/HAP is a new field in which the NCTLD has initiated a new program of activities. Particularly, susceptibility of tuberculosis patients to nosocomial pathogens as a possible cause of "difficult-to-treat" lung infections is one of NCTLD's priority fields. For instance, it was reported that the possibility of co-existing Legionellosis should be considered in all patients with difficult-to-treat acute and chronic chest infections, particularly in developing countries where TB is very common (*26, 27*). *L. pneumophila* and *M. tuberculosis* co-existence was identified in multiple specimens of patients presenting with acute respiratory distress syndrome (*27*). Furthermore, this co-morbidity extends to *P. aeruginosa* as well, as was shown on mice infected with *Mycobacterium bovis* that were shown to be highly susceptible to subsequent challenge with *P. aeruginosa*. The susceptibility was characterized by the enhanced mortality and shortened survival after challenge with *P. aeruginosa* (*28*). The NTCLD has extensive expertise in lung diseases and will be priceless addition to the project. NCTLD staff will contribute to isolation and characterization of causative agents from medicinal samples collected from patients. NCTLD personnel will implement their medical practices to develop a lab-scale trial with newly selected and genetically engineered phages. In addition, a research team at the NCTLD has extensive experience with genotyping and DNA sequencing of various infectious agents

NCTLD project participants.

1. Sergo Vashakidze, Sc.D, Professor- scientific leader on the project and NCTLD sub-manager; will oversee project performance at NCTDL and communicate with Project manger; He will contribute to the reporting, IP protection and manuscripts preparation. He will support seminars, meetings and results analysis.
2. Natalia Shubladze, PhD - group leader; experimental microbiologist and molecular biologist; investigator, she will supervise laboratory work; will perform PFGE genetic analysis for *Ps. aeruginosa* and for phage strains (genome sequencing) and bioinformatics analysis.
3 Lali Kupreishvili, PhD – physician, experimental investigator; she will supervise clinical specimens transferring to the General Microbiology Laboratory, procurement procedures, monitor men /hours for the team; she will take part in the experimental study and results assessment, and will contribute to protocols and manuscripts development.
4. Iagor Kalandadze, Sc.D – leading expert and consultant in biophysics; he will take part in the results analysis and contribute to manuscript preparation; additionally, he will be responsible for administrative and procurement questions issues.
5. Nadejda Revishvili , MS - experimental microbiologist; will be responsible for the general microbiology protocols, isolation of Ps. aeruginosa clinical strains, their identification, drug susceptibility testing, and characterization.

6. Nino Bablishvili, PhD - experimental microbiologist and molecular biologist; will be responsible for PFGE-genetic analysis of *Ps. aeruginosa*, and also for genetic analysis of isolated phage strains genome sequencing), and bioinformatics analysis.
7. Nona Tadumadze, PhD - experimental microbiologist and molecular biologist; will be responsible for PFGE-genetic analysis of *Ps. aeruginosa*, and also for genetic analysis of isolated phage strains (genome sequencing), and bioinformatics analysis.
8. Maka Akhalaia - experimental microbiologist and molecular biologist; will be responsible for PFGE- genetic analysis of *Ps. aeruginosa*, and also for genetic analysis of isolated phage strains (genome sequencing), and bioinformatics analysis.
9. Nana Dokvadze - experimental microbiologist; will assist in general microbiology and molecular biology protocols.

NCTLD Selected publications

1. L. Vashakidze, N.Shubladze et al. Prevalence and risk factors for drug resistance among hospitalized tuberculosis patients in Georgia. International J of Tuberculosis and Lung Diseases,13(9), 2009.
2. M. Kuniholm, N.Shubladze et al. Risk factors and algorithms to identify hepatitis C, hepatitis B, and HIV among Georgian tuberculosis patients, International J. Infectious Diseases, 12(1), 2008.
3. N. Shubladze et al. Molecular typing of *M. tuberculosis* regional strains, isolated in Georgia. Proc. Georgian Acad. Sci., Biol. Ser. 31(6), 2005.
4. M. Gegia, M.Akhalaia et al. Prevalence of and molecular basis for tuberculosis drug resistance in the Republic of Georgia: validation of a templex system for the detection of drug resistance-related mutations. Antimicrobial Agents and Chemotherapy, 2, 2008.
5. N. Shubladze et al. Use of various media for *M. tuberculosis* drug susceptibility testing in Georgia. Proc. Georgian Ac Sci. Biol. Ser 6 (31), 2005.
6. N. Mdivani, N.Shubladze et al. High prevalence of multidrug-resistant tuberculosis in Georgia. Int. J Infectious Diseases,*12, 2008*
7. D. Richards, N.Shubladze et al. High prevalence of hepatitis C virus infection but not HIV co-infection among patients with tuberculosis in the Republic of Georgia. Int. J of Tuberculosis and Lung Diseases, 10(4), 2006.
8. L. Danelishvili, N.Shubladze et al. Emergence of drug-dependent *M. tuberculosis* strains among patients with pulmonary tuberculosis. Proc. Georgian Acad. Sci., Biol. Ser 25 (1), 1999.

Scientific significance and uniqueness

Bacteriophages had not yet been explored as natural, environmentally safe means to protect health care facilities and industrial settings from biofouling microbes, which are dangerous for humans and animals, and cause significant loss in the industries. This project should be considered as one of the first attempt to genetically engineer bacteriophages, which combines the strength of natural phages with the capability of hydrolytic enzymes to destroy biofilms. Due to ultimate innovation of proposed study, it is anticipated to generate IP and to publish the results of the project in international peer reviewed journals.

Economic and industrial benefits

The rise of MDR biofouling pathogens has been called one of the world's most pressing public health problems. The bacteria living in a biofilm are the cause for constant biofouling and biocorrosion in Industry costing $15B annually. Health care system and Industry losses causing by biofouling microbes as high as $21B per year (*2*). The preparations developed on the project have a visible perspective to contribute to a reduction of the cost associated with controlling a spread of biofouling microbes. Should the approach implemented in this project resulted in effective phages destroying biofouling human pathogens, such as *Legionella* and *Pseudomonas*, similar approach could be used to develop phage-based preparations for the other biofouling microorganisms such as causing pipelines corrosion, etc.

Commercial significance

Commercial significance for the Institutes could be expected from commercialization of IP generated on the project. There are a few fields of use where bacteriophages capable of eradicating biofouling microbes could be on demand: disinfection of medical appliances, disinfecting of healthcare facilities, cruise ships, public places, HVAC systems, etc; usage as anti-corrosion tool; application as prophylactic measures, and to enhance antibiotic efficacy. Republic of Georgia has significant capability for commercialization of new bacteriophges should such phages resulted from the project. JSC Biochimpharm (Tbilisi) will be the first place for phages mass production. Additionally, Eliava Institute had been previously demonstrated a commercialization success by transferring their scientific achievements to the product line.

Benefits to the Institutes
The Institutes and project participants will benefit from integration with western scientific community. New approaches developed under the projects and new results will be patented, published, and presented to the International scientific community. The project will support trained and skilled staff and address their knowledge and efforts to the development of highly valuable civilian product.

Deliverables	Due date (by the end of Month # __)	Point (address) of delivery
Inventory and detailed characteristics of all available *L. pneumophila* and P. *aeruginosa* and corresponding phages	On Completion of Milestone 1	PNNL
Fully characterized lytic *P. aeruginosa* and *L. pneumophila*-targeting bacteriophages; at least three, for each	On completion of Milestone 2	PNNL
Sequencing and bioinformatic analysis of selected phages.	On completion of Milestone 3	PNNL
Results of efficacy trail with engineered phages	On completion of Milestone 4	PNNL
Fully characterized dual-specificity phages	On completion of Milestone 5	PNNL

5. Scope of Activities
The scope of the project will be focused on selection, characterization and engineering of novel bacteriophages capable of directly degrading the biofilm, destroying the population and the shelter of the bacteria. Detailed description of each Milestone follows.

Year 1 (1 -12 months; 1- 4 Quarters)
Milestone 1: A development of inventory of available bacteriophages and bacteriophages hosts, and its initial characterization.

Subtask 1. Inspecting the stock of available isolated phages and corresponding bacterial strains.
Stock of the available inventories at all institutions-participants will be screened and inventory/library of *Legionella* and *Pseudomonas* bacteriophages, along with their deposited propagation hosts will be constructed

Subtask 2. De-novo isolation and screening of *Legionella* and, if needed, *Pseudomonas strains* and corresponding bacteriophages.
Single-Host Isolation Methods from the Environment and Single-Host Isolation Methods for seclusion of bacteriophages that are already present in the host will be applied to enrich the collection of bacteriophages for further study

Subtask 3. Screening of available bacteriophage strains' host specificity
All available phages will be screened against all available isolates of *Legionella* and *Pseudomonas*

The goals of Subtasks 1- 3 will be achieved through the screening a stock of the available inventories at all participating institutes. Characterization of bacteriophages and host cultures will be based upon historic data from the institutes' records, and will be additionally generated by running the basic characterizations as described in the methods; characterization will include as much information about the genetic backgrounds, medical, target, and environmental data as possible. Additionally *Legionella* strains /*Legionella* phages and, if necessarily, Pseudomonas strains/Pseudomonas phages will be de-novo isolated and characterized, to increase the stock of microbial strains and bacteriophages for further study. All available phages will be screened against all available isolates of *Legionella* and *Pseudomonas*, particularly the ones forming the thickest biofilms and the ones possessing multidrug resistance.

Participating Institutions: 1- IBMV, 2-NCDC, and 3-NCTLD
Description of deliverables: Written report including but not limited to a detailed characterization of phages and corresponding host microbes accrued from screened collections and isolated de-novo. Additionally, a matrix of the susceptibility of the strains of *L. pneumophila* and *P. aeruginosa*, both reference strains and new isolates of the bacteriophages that are available will be provided. The Legionella strains to be screened will include, but not

limited to the four isolated strains belonging to the *L. pneumophila* serogroup-1 deposited in the NCDC collection of live microorganisms in 2009. This includes initial detailed OD600 and CFU/viability time-course data, as well as long-term susceptibility, i.e., repression potential of bacteriophages

Milestone 2. Characterization and assessment of available phage strains.

Subtask 1. Thorough analysis of the data received in Milestone 1 and selection of the most prominent *Legionella* and *Pseudomonas* bacteriophages for further investigation.
The phages that are able to suppress cultures of longer periods of time will be given the preference over others. A matrix of susceptibility identifying the top three lytic *P. aeruginosa* and top three lytic *L. pneumophila* bacteriophages will be prepared.

Subtask 2. Characterization of pre-selected *Legionella* phages
The methods for genomic composition of the bacteriophages analysis will include but not limited to size, GC-content, melting temperature as a proxy of secondary structure, methylation, resistance to restriction digests, focusing on the endogenous restriction systems of *Legionella* but including all commercially available common enzymes, e.g., New England Biolabs. To organize the candidate bacteriophages into phylogenetic groups to build a basic phylogeny model more detailed genomic composition of the bacteriophages will then be obtained using PFGE. All candidate phages will be tested for insertion into host genomes, packaging, and characterization of any amount of host DNA, because that is a strong negative exclusion criterion. Morphological study will be performed using Transmission Electron Microscopy

Subtask 3. Characterization of pre-selected *Pseudomonas* phages
Characterization of *Pseudomonas* phages will be performed similarly to that described in Millstone 2, Subtask 1 for characterization of *Legionella* phages.

Participating Institutions: 1- IBMV, 2-NCDC, 3-NCTLD
Description of deliverables: Written report including composition and basic phylogeny based on morphology and genomic profiling. High-titer, recently propagated stocks of top three lytic characterized *P. aeruginosa* and lytic *L. pneumophila*-targeting bacteriophages will be prepared at the end of this Milestone.

Year 2 (13-24 month; 5-8 Quarters)

Milestone 3. Bacteriophages sequencing and bioinformatic characterization

Subtask 1. Complete sequencing of pre-selected *Legionella* phages genome.
This process necessitates the generation of a high-quality fragment library, and will be implemented by the participants. If necessary, commercial providers like Beckman Coulter's Agencourt division will be involved (TBD).

Subtask 2. Complete sequencing of pre-selected *Pseudomonas* phages genome.
This process necessitates the generation of a high-quality fragment library, and will be implemented by the participants. If necessary, commercial providers like Beckman Coulter's Agencourt division will be involved (TBD).

Subtask 3. Bioinformatic analysis of phage genomes
Typical annotation expert systems, such as the Bacterial Annotation System (BASys), as well as more specific protein homology programs like Pfam, PROSITE, and PSIPRED will be chosen to perform automated analysis of the initial draft of sequenced phages genome.

The goal of Milestone 3 is to select appropriate bacteriophages for a development of a platform for engineering of bacteriophages with hydrolytic activity. To achieve this goal, bacteriophages candidates characterized in previous Milestones will be fully sequenced and the bioinformatic analysis will be carried out.

Participating Institutions: 1- IBMV, 2-NCDC, 3-NCTLD
Description of deliverables: Written report including the results of sequencing and bioinformatic characterization.

Milestone 4. Testing of engineered bacteriophages efficacy.

Subtask 1 Engineering of *L. pneumophila* phages with biofilm-degrading enzymes

Assist the project partner in genetic engineering of top candidate phage genomes, including identification of insertion sites, insertion of specific biofilm-degrading enzymes such as Dispersin B, Alginase, and DNAse or its combination of two or all three, and establishing basic isolation and molecular cloning procedures for the respective bacteriophages.

Subtask 2 Engineering of *P. aeruginosa* phages with biofilm-degrading enzymes .

Assist the project partner in genetic engineering of top candidate phage genomes, including identification of insertion sites, insertion of specific biofilm-degrading enzymes such as Dispersin B, Alginase, and DNAse or its combination of two or all three, and establishing basic isolation and molecular cloning procedures for the respective bacteriophages.

Subtask 3. Development of a protocol for validation of efficacy of recombinant phage-based preparations against *P. aeruginosa and L. pneumophila*
This Milestone will be a culminating point on the project. A protocol will be developed and implemented for non-human subject trial to assess an efficacy of recombinant phage-based preparations designed in previous Milestones. *P. aeruginosa* and *L. pneumophila* biofilms will be grown on coupons of the materials characteristic of HVAC, pipes, and hospital interior and treated with recombinant phages. Appropriate methods will be used to detect biofilm and viable cells count. The efficacy of recombinant phages will be asseses by comparison with native phages efficacy. All appropriate controls will be performed

Participating Institutions: 1- IBMV, 2-NCDC, 3-NCTLD
Description of deliverables: Written report including detailed protocol of the experimental set-up and experimental results. The report will also include the illustration of biofilms grown on the materials before and after bacteriophages application. Viability of microbes remained in biofilm after phages application will be assessed by two independent methods.

Milestone 5: Isolation and characterization of Dual-Specificity Bacteriophages

Subtask 1. Isolation of dual-specificity bacteriophages.

An attempt will be given to isolate novel bacteriophages specific for both, *L. pneumophila* and *P. aeruginosa* from NCTLD (hospital) efflux and from wards that are treating patients with pneumonia, as these environmental streams have the highest chance of containing novel bacteriophages. Bacteriophages of dual specificity would be highly valuable to simultaneously control both pathogens. Multi-Host Isolation will be focusing on isolating more broad-spectrum bacteriophages by an enrichment procedure. For this environmental water samples or efflux samples are amended with an equal volume of growth medium containing overnight cultures of *L. pneumophila* and *P. aeruginosa*. When enrichments are performed with the simultaneous addition of two bacterial host species, previously unknown bacteriophages can obtained that have multiple isolation hosts.

Subtask 2. Characterization of Novel Dual-Specificity Bacteriophages
If Subtask 1 is a success, the characterization of dual-specificity bacteriophages will be done with the same accuracy as was described in Milestones 1-3

Subtask 3. **:** IP assessment and final report preparation
All data received through the project will be statistically treated and analyzed. Final report will be prepared and will compile all major results generated on the project in rational order. IP assessment will be conducted to identify the subjects for patenting. If no IP protection is required, the manuscripts will be prepared for publishing in peer-reviewed journals. If patent application would be filed, the articles publication would be postpone to secure the IP.

Participating Institutions: 1- IBMV, 2- NCTLD, 3- NCDC
Description of deliverables: Written report, including protocols, results, and data analysis

6. Technical Approach and Methodology

The following brief descriptions of experimental approaches gives an overview of the most commonly used techniques to: 1) isolate, characterize, and engineer bacteriophages, and 2) determine the genetic diversity of *P. aeruginosa* and *L. pneumophila* isolates
The best practice methods will include but will not be limited to the following:
I. For isolation of Bacteriophages
a) Single-Host Isolation methods from the environment, such as tangential flow filtration, was found to be between 50% to 80% efficient in recovering bacteriophages from aquatic samples, the preferred kind of sample.
b) Single-Host Isolation Methods via the Induction of Lysogens will be used for the generation of bacteriophages that are already present in the host, i.e., such bacteriophages that are able to infect and propagate within the host;

these bacteriophages will only be considered as a fail-safe method to obtain candidate bacteriophages for engineering.

c) Multi-Host isolation methods will be used for isolating more broad-spectrum bacteriophages by an enrichment procedure in which environmental water samples or efflux samples are used on multiple hosts (*29*). This method in particular is going to be key in trying to find bacteriophages that are able to infect both hosts, *P. aeruginosa* and *P. pneumophila*, and do so efficiently.
d) Genotyping of *P. aeruginosa* and *L. pneumophila* isolates will be conducted using a standard PFGE methodology.
II. For characterization of bacteriophages
a) Transmission Electron Microscopy will be used as the most common method of characterizing a bacteriophage, as it allows the assignment of a particular bacteriophage to the existing 14 groups of prokaryotic bacteriophages (and 5 potential further group
b) Basic Genomic Analysis Techniques will be applied to characterize the genome and type of bacteriophage obtained through isolation to determine the GC content and melting temperatures of the genomic DNA. If necessary, high-performance liquid chromatography techniques will be used to determine the base composition. For this, DNAses will be used to completely degrade the DNA and to release nucleotides, which can then be quantified.
c) Genomic fingerprinting will be performed using PFGE, which is more sophisticated step in categorizing the isolated phage. The pattern is specific for each phage subgroup and allows for the grouping of like bacteriophages into families for further analysis
d) Genome sequencing and bioinformatics analysis will be used as the most-thorough approach to characterizing an isolated bacteriophage. This will require the generation of a high-quality fragment library for sequencing. Bioinformatics analysis of the initial draft of a phage genome is an automated process that is curate by hand post-completion. Typical annotation expert systems, the Bacterial Annotation System (BASys), as well as more specific protein homology programs such as Pfam, PROSITE and PSIPRED will be in use.
III. For genotyping of P. aeruginosa and L. pneumophila isolates
The PFGE will be used for molecular typing of *P. aeruginosa* and *L. pneumophila* isolates. The PFGE for *P. aeruginosa* will be performed using a standard methodology with a CHEF DRII drive module (Bio-Rad, Richmond, Calif.). PFGE macro-restriction patterns for *P. aeruginosa* and *L. pneumophila* isolates will be analyzed using Bionumerics software (version 3, Applied Maths)

7. Project Location and Facilities

Leading Institution: G. Eliava Institute of Bacteriophages, Microbiology, and Virology
3 Gotua Str., Tbilisi 0160, Georgia,
Laboratory (Rooms 5) Equipment: BSL2 -2, Electronic microscope, Microscopes-4, Spectrophotometer-2, PFGE equipment-1, pH-meter-2, Distillator-3, Refrigerators-5, Freezer-1,
Incubator-2, Autoclave-2, Centrifuge-4 (refrigerated and ultracentrifuge), Vortex mixer-2, Magnet shaker/heater-1 Bacti-cinerator-2, Electrophoresis machine -1,PC -1,Scanner-1, Printer-1

Participant Institution 1: National Center for Disease Control and Public Health of Georgia
9 Asatiani Str., Tbilisi 0177, Georgia
Laboratory (Rooms 7) Equipment: BSL2 -2, Incubator-2, Microscopes-4, PFGE equipment-1, pH-meter-2, Distillator-2, Spectrophotometer-2, Refrigerators-3, Freezer-1, Autoclave-2, Centrifuge-2 (refrigerated and ultracentrifuge), Vortex mixer-2, Magnet shaker/heater-1, Bacticinerator-2, PC -1, Printer-1

Participant Institution 2: National Center of Tuberculosis and Lung Diseases of Georgia
8 Adjara Street, Tbilisi 0101, Georgia
Laboratory (Rooms 4), Equipment: BSL2 -2, Incubator-3, Microscopes-8, pH-meter-1, Distillator-3, Spectrophotometer-1, Refrigerators-5, Freezer-1, Autoclave-2, Centrifuge-2 (refrigerated and ultracentrifuge), Vortex mixer-1, Magnet shaker/heater-1, Bacticinerator-1, PC -3, Scanner-1, Printer-1

8. Financial Information
Table 1 presents Work schedule specified for each participating institution as identified by I-Code.
Table 2 presents Work schedule chart.
Budget categories (allowable direct cost) are specified in the following tables:
Grant payments: Table 3
Equipment: Table 4
Materials: Table 5
ODC: Table 6
Travel: Table 7
Tables 8 and 9 present financial summary including overhead for participation institutions.
Tables S8 and S8 present financial summary for each participating institution separately

Table 1. Work Schedule / Таблиця 1. Розклад робіт

Stages / Substages*				Estimate Work Days													Milestones	
# Stages	#.# Stages	Name	Institution short name	Qtr1	Qtr2	Qtr3	Qtr4	Qtr5	Qtr6	Qtr7	Qtr8	Qtr9	Qtr10	Qtr11	Qtr12	Total by stage	Name	months
1		A development of inventory of available bacteriophages and bacteriophages hosts, and its initial characterization														2296	1. Inventory and detailed characteristics.of all available L. pneumophila and P. aeruginosa and corresponding phages	12
	1,1	Inspecting the stock of available isolated phages and corresponding bacterial strains	NCDC&PH	171	171	171	171	0	0	0	0	0	0	0	0		1.1 Stock of the available inventories at all institutions-participants will be screened and inventory/library of Legionella and Pseudomonas bacteriophages, along with their deposited propagation hosts will be constructed	
	1,2	De-novo isolation and screening of Legionella and, if needed, Pseudomonas strains and corresponding bacteriophages	IBMV	202	202	298	297	0	0	0	0	0	0	0	0		1.2 Single-Host Isolation Methods from the Environment and Single-Host Isolation Methods for seclusion of bacteriophages that are already present in the host will be applied to enrich the collection of bacteriophages for further study	
	1,3	Screening of available bacteriophage strains' host specificity	NCTLD	153	153	153	154	0	0	0	0	0	0	0	0		1.3 All available phages will be screened against all available isolates of Legionella and Pseudomonas backgrounds, medical, target, and environmental data as possible	
2		Characterization and assessment of available phage strains														2322	2. Fully characterized lytic P. aeruginosa and L. pneumophila-targeting bacteriophages; at least three, for each	12
	2,1	Selection of the most prominent Legionella and Pseudomonas bacteriophages for further investigation	IBMV	166	166	197	197	0	0	0	0	0	0	0	0		2.1 A matrix of susceptibility identifying the top three lytic P. aeruginosa and top three lytic L. pneumophila bacteriophages will be prepared.	
	2,2	Characterization of pre-selected Legionella phages	NCDC&PH	192	192	192	192	0	0	0	0	0	0	0	0		2.2 Genomic composition and morphological structure of pre-selected Legionella phages will be studied	
	2,3	Characterization of pre-selected Pseudomonas phages	NCTLD	207	207	207	207	0	0	0	0	0	0	0	0		2.3 Genomic composition and morphological structure of pre-selected phages Pseudomonas phages will be studied	
3		Bacteriophages sequencing and bioinformatic characterization														1275	3. Sequencing and bioinformatic analysis of selected phages.	24
	3,1	Complete sequencing of pre-selected Legionella phages genome	IBMV	0	0	0	0	131	130	130	128	0	0	0	0		3.1 This process necessitates the generation of a high-quality fragment library, and will be implemented by the participants	
	3,2	Complete sequencing of pre-selected Pseudomonas phages genome	NCTLD	0	0	0	0	99	99	99	99	0	0	0	0		3.2 This process necessitates the generation of a high-quality fragment library, and will be implemented by the	
	3,3	Bioinformatic analysis of phage genomes	NCDC&PH	0	0	0	0	90	90	90	90	0	0	0	0		3.3 Will be performed automated analysis of the initial draft of sequenced phages genome	
4		Testing of engineered bacteriophages efficacy														2020	4. Results of efficacy trail with engineered phages	24
	4,1	Engineering of L. pneumophila phages with biofilm-degrading enzymes	IBMV	0	0	0	0	118	118	118	118	0	0	0	0		4.1 Assist the project partner in genetic engineering of top candidate L. pneumophila phage genomes	
	4,2	Engineering of P. aeruginosa phages with biofilm-degrading enzymes	NCTLD	0	0	0	0	186	186	186	187	0	0	0	0		4.2 Assist the project partner in genetic engineering of top candidate P. aeruginosa phage genomes	

	4,3	Development of a protocol for validation of efficacy of recombinant phage-based preparations against P. aeruginosa and L. pneumophila	NCDC&PH	0	0	0	0	200	201	201	201	0	0	0	0		4.3 A protocol will be developed and implemented for non-human subject trial to assess an efficacy of recombinant phage-based preparations designed in previous Milestones.	
5		IIsolation and characterization of Dual-Specificity Bacteriophages														1623	5. Fully characterized dual-specificity phages	24
	5,1	Isolation of dual-specificity bacteriophages	IBMV	0	0	0	0	243	243	243	241	0	0	0	0		5.1 An attempt will be made to isolate and characterize novel bacteriophages specific for both, L. pneumophila and P. aeruginosa strains	
	5,2	Characterization of Novel Dual-Specificity Bacteriophages	NCTLD	0	0	0	0	75	75	75	75	0	0	0	0		5.2 If Subtask 1 is a success, the characterization of dual-specificity bacteriophages will be done	
	5,3	IP assessment and final report preparation	NCDC&PH	0	0	0	0	88	88	88	89	0	0	0	0		5.3 All data received through the project will be statistically treated and analyzed.	
Total Work Days:				1091	1091	1218	1218	1230	1230	1230	1228	0	0	0	0	9536		

1091	1091	1218	1218	1230	1230	1230	1228	0	0	0	0	9536

Table 2. Work Schedule Chart / Таблиця 2. Діаграма етапів проекту

Stage number	Beginning date	Duration, months	Q1			Q2			Q3			Q4			Q5			Q6			Q7			Q8			Q9			Q10			Q11			Q12		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1 Stage	1	12																																			
			A development of inventory of available bacteriophages and bacteriophages hosts, and its initial characterization																																		
2 Stage	1	12																																			
			Characterization and assessment of available phage strains																																		
3 Stage	13	12																																			
			Bacteriophages sequencing and bioinformatic characterization																																		
4 Stage	13	12																																			
			Testing of engineered bacteriophages efficacy																																		
5 Stage	13	12																																			
			IIsolation and characterization of Dual-Specificity Bacteriophages																																		
6 Stage																																					
			#N/A																																		
7 Stage																																					
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Table 3. Personal Commitment / Таблиця 3. Участь персоналу

#	Surname (in English)	First Name	Codes I-Code	Date of birth	W.Code	Place in Project	Acad. Rank	V-Code	Daily Rate	Days Qtr1	Qtr2	Qtr3	Qtr4	Qtr5	Qtr6	Qtr7	Qtr8	Qtr9	Qtr10	Qtr11	Qtr12	Total days	% of Time	Cost Qtr1	Qtr2	Qtr3	Qtr4	Qtr5	Qtr6	Qtr7	Qtr8	Qtr9	Qtr10	Qtr11	Qtr12	Total Cost
1	Gabisonia	Tarasi	1	23.10.1958	1.3	PM, EI, TI	Professor	P	70	25	25	37	37	37	37	37	37	0	0	0	0	272	62	1750	1750	2590	2590	2590	2590	2590	2590	0	0	0	0	19 040
2	Loladze	Manana	1	04.11.1960	1.3	GL, EI, TI	PhD	P	45	32	32	51	51	51	50	50	50	0	0	0	0	367	83	1440	1440	2295	2295	2295	2250	2250	2250	0	0	0	0	16 515
3	Chanishvili	Lamara	1	15.08.1928	1.3	EI	Specialist	P	35	25	25	39	39	38	38	38	38	0	0	0	0	280	64	875	875	1365	1365	1330	1330	1330	1330	0	0	0	0	9 800
4	Chakhunashvil	Natela	1	10.01.1950	1.3	EI	PhD	P	35	25	25	39	39	38	38	38	38	0	0	0	0	280	64	875	875	1365	1365	1330	1330	1330	1330	0	0	0	0	9 800
5	Nadiradze	Manana	1	09.01.1947	1.3	EI	PhD	P	35	25	25	39	38	38	38	38	38	0	0	0	0	279	63	875	875	1365	1330	1330	1330	1330	1330	0	0	0	0	9 765
6	Turmanidze	Tsitsino	1	07.09.1935	1.3	EI	PhD	P	35	28	28	28	28	28	28	28	28	0	0	0	0	224	51	980	980	980	980	980	980	980	980	0	0	0	0	7 840
7	Alibegashvili	Maia	1	01.08.1963	1.3	EI	Specialist	P	35	36	36	36	36	36	36	36	36	0	0	0	0	288	65	1260	1260	1260	1260	1260	1260	1260	1260	0	0	0	0	10 080
8	Georgadze	Marine	1	12.02.1957	1.3	EI	Specialist	P	30	39	39	39	39	39	39	39	39	0	0	0	0	312	71	1170	1170	1170	1170	1170	1170	1170	1170	0	0	0	0	9 360
9	Didebulidze	Kakha	1	28.02.1977	0	EI	PhD	P	30	25	25	52	52	52	52	52	50	0	0	0	0	360	82	750	750	1560	1560	1560	1560	1560	1500	0	0	0	0	10 800
10	Melashvili	Giorgi	1	05.11.1978	0	EI	PhD	P	30	25	25	52	52	52	52	52	50	0	0	0	0	360	82	750	750	1560	1560	1560	1560	1560	1500	0	0	0	0	10 800
11	Pataridze	Irina	1	31.10.1960	0	EI	Specialist	P	30	45	45	45	45	45	45	45	45	0	0	0	0	360	82	1350	1350	1350	1350	1350	1350	1350	1350	0	0	0	0	10 800
12	Kochlamazashvili	Ketevan	1	18.10.1978	0	EI	PhD	P	30	38	38	38	38	38	38	38	38	0	0	0	0	304	69	1140	1140	1140	1140	1140	1140	1140	1140	0	0	0	0	9 120
13	Mgeladze	Gela	2	06.01.1962	1.3	PIM, EI	PhD	P	45	32	32	32	32	32	32	32	32	0	0	0	0	256	58	1440	1440	1440	1440	1440	1440	1440	1440	0	0	0	0	11 520
14	Katsitadze	Guram	2	16.06.1934	1.3	GL	Doctor	P	40	25	25	25	25	25	25	25	25	0	0	0	0	200	45	1000	1000	1000	1000	1000	1000	1000	1000	0	0	0	0	8 000
15	Tsertsvadze	Nikiloz	2	31.05.1938	1.3	EI	PhD	P	40	25	25	25	25	25	25	25	25	0	0	0	0	200	45	1000	1000	1000	1000	1000	1000	1000	1000	0	0	0	0	8 000
16	Tsanava	Shota	2	08.01.1957	1.3	TI	PhD	P	45	25	25	25	25	25	25	25	25	0	0	0	0	200	45	1125	1125	1125	1125	1125	1125	1125	1125	0	0	0	0	9 000
17	Imnadze	Paata	2	11.03.1953	1.3	GL, TI	PhD	P	40	26	26	26	26	26	26	26	27	0	0	0	0	209	48	1040	1040	1040	1040	1040	1040	1040	1080	0	0	0	0	8 360
18	Grdzelidze	Marina	2	27.01.1950	1.3	EI	Specialist	P	40	35	35	35	35	35	35	35	35	0	0	0	0	280	64	1400	1400	1400	1400	1400	1400	1400	1400	0	0	0	0	11 200
19	Mirianashvili	Zurab	2	09.08.1963	1.3	EI	Specialist	P	35	30	30	30	30	30	31	31	31	0	0	0	0	243	55	1050	1050	1050	1050	1050	1085	1085	1085	0	0	0	0	8 505
20	Chubinidze	Svetlana	2	24.05.1970	1.3	EI	Specialist	P	35	32	32	32	32	32	32	32	32	0	0	0	0	256	58	1120	1120	1120	1120	1120	1120	1120	1120	0	0	0	0	8 960
21	Chanturia	Gvantsa	2	31.10.1972	1.3	EI	Specialist	P	35	17	17	17	17	32	32	32	32	0	0	0	0	196	45	595	595	595	595	1120	1120	1120	1120	0	0	0	0	6 860
22	Datukishvili	Sophio	2	14.02.1982	0	EI	Specialist	P	35	30	30	30	30	30	30	30	30	0	0	0	0	240	55	1050	1050	1050	1050	1050	1050	1050	1050	0	0	0	0	8 400
23	Khmaladze	Ekaterine	2	03.08.1987	0	EI	Specialist	P	35	28	28	28	28	28	28	28	28	0	0	0	0	224	51	980	980	980	980	980	980	980	980	0	0	0	0	7 840
24	Pirtskhalaishvili	Giorgi	2	25.09.1982	0	EI	Specialist	P	35	30	30	30	30	30	30	30	30	0	0	0	0	240	55	1050	1050	1050	1050	1050	1050	1050	1050	0	0	0	0	8 400
25	Kometiani	Tevdore	2	27.03.1978	0	LA	Specialist	P	35	28	28	28	28	28	28	28	28	0	0	0	0	224	51	980	980	980	980	980	980	980	980	0	0	0	0	7 840
26	Vashakidze	Sergo	3	30.07.1957	1.3	PIM, TI	Doctor	P	50	55	55	55	55	55	55	55	55	0	0	0	0	440	100	2750	2750	2750	2750	2750	2750	2750	2750	0	0	0	0	22 000
27	Shubladze	Natalia	3	01.08.1964	1.3	GL, EI	PhD	P	45	54	54	54	54	54	54	54	54	0	0	0	0	432	98	2430	2430	2430	2430	2430	2430	2430	2430	0	0	0	0	19 440
28	Kupreishvili	Lali	3	07.02.1958	1.3	EI	PhD	P	38	45	45	45	45	45	45	45	45	0	0	0	0	360	82	1710	1710	1710	1710	1710	1710	1710	1710	0	0	0	0	13 680
29	Kalandadze	Iagor	3	26.10.1964	1.3	CT	Doctor	P	70	8	8	8	9	8	8	8	9	0	0	0	0	66	15	560	560	560	630	560	560	560	630	0	0	0	0	4 620
30	Akhalaia	Maka	3	20.02.1971	1.3	EI	Specialist	P	30	45	45	45	45	45	45	45	45	0	0	0	0	360	82	1350	1350	1350	1350	1350	1350	1350	1350	0	0	0	0	10 800
31	Revishvil	Nadezhda	3	14.02.1947	0	EI	Specialist	P	25	40	40	40	40	40	40	40	40	0	0	0	0	320	73	1000	1000	1000	1000	1000	1000	1000	1000	0	0	0	0	8 000
32	Dokvadze	Nana	3	08.06.1961	0	EI	Specialist	P	25	35	35	35	35	35	35	35	35	0	0	0	0	280	64	875	875	875	875	875	875	875	875	0	0	0	0	7 000
33	Bablishvili	Nino	3	23.07.1974	0	EI	PhD	P	30	39	39	39	39	39	39	39	39	0	0	0	0	312	71	1170	1170	1170	1170	1170	1170	1170	1170	0	0	0	0	9 360
34	Tadumadze	Nona	3	26.10.1976	0	EI	Specialist	P	30	39	39	39	39	39	39	39	39	0	0	0	0	312	71	1170	1170	1170	1170	1170	1170	1170	1170	0	0	0	0	9 360
																						0	0	0	0	0	0	0	0	0	0	0	0	0	0
																						0	0	0	0	0	0	0	0	0	0	0	0	0	0
																						0	0	0	0	0	0	0	0	0	0	0	0	0	0
																						9536		40060	40060	44845	44880	45265	45255	45255	45245	0	0	0	0	350 865

Short Institution Name	I-Code	Total People																											
IBMV	1	12	Total:	368	368	495	494	492	491	491	487	0	0	0	0	3686		13215	13215	18000	17965	17895	17850	17850	17730	0	0	0	0	133720
NCDC&PH	2	13	Total:	363	363	363	363	378	379	379	380	0	0	0	0	2968		13830	13830	13830	13830	14355	14390	14390	14430	0	0	0	0	112885
NCTLD	3	9	Total:	360	360	360	361	360	360	360	361	0	0	0	0	2882		13015	13015	13015	13085	13015	13015	13015	13085	0	0	0	0	104260
	4	0	Total:	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
	5	0	Total:	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0
FWS:	Total	22	Sub-total(FWS:)	689	689	762	762	774	774	774	776	0	0	0	0	6000		27795	27795	30960	30995	31380	31370	31370	31480	0	0	0	0	243145
NFWS:	Total	12	Sub-total(NFWS:)	402	402	456	456	456	456	456	452	0	0	0	0	3536		12265	12265	13885	13885	13885	13885	13885	13765	0	0	0	0	107720
Total:	Total	34	Grand Total:	1091	1091	1218	1218	1230	1230	1230	1228	0	0	0	0	9536		40060	40060	44845	44880	45265	45255	45255	45245	0	0	0	0	350865

Project Codes: PM - Project Manager, PIM - Participating institution manager, GL - Group leader, EI - Experimental investigation, TI - Theoretical investigation, TD - Technology development, DN - Designing, SL - Simulation, CT - Consulation, TL - Translator, LA - Laboratory assitant, SP - Support person,

Table 4. Equipment / Таблиця 4. Обладнання

#	Description	Inst.	Anticipated Use	V-Code	P-Code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total
Capital (Cost per item >= $2500)																		
1	Pulsed Gel Field Electrophoresis CHEF-DR III System	3	Investigation of bacteriophages and P. aeruginosa Isolates by Pulsed Gel Field Electrophoresis	P	R	30000	0	0	0	0	0	0	0	0	0	0	0	**30000**
																		0
																		0
Non_Capital (Cost per item < $2500)																		
1	Laptop	1	Development of typical record documentation and communication with partners	C	R	1000	0	0	0	0	0	0	0	0	0	0	0	**1000**
2	Laptop	3	Development of typical record documentation and communication with partnors and collaborator	C	R	1700	0	0	0	0	0	0	0	0	0	0	0	**1700**
3	Xerox	2	Development of typical record documentation,	C	R	0	0	0	0	1000	0	0	0	0	0	0	0	**1000**
4	Autoclave	1	For sterilization of nutrient medium	C	R	2000	0	0	0	0	0	0	0	0	0	0	0	**2000**
5	Deaktop PC	1	Development of typical record documentation and communication with partners	C	R	600	0	0	0	0	0	0	0	0	0	0	0	**600**
6	LCD Monitor	1	For Desktop computer	C	R	400	0	0	0	0	0	0	0	0	0	0	0	**400**
7	LCD Monitor	2	Development of typical record documentation	C	R	400	0	0	0	0	0	0	0	0	0	0	0	**400**
8	Deaktop PC	2	Development of typical record documentation	C	R	0	0	0	0	600	0	0	0	0	0	0	0	**600**
9	Deaktop PC	2	Development of typical record documentation	C	R	600	0	0	0	0	0	0	0	0	0	0	0	**600**
10	LCD Monitor	2	For desktop computer	C	R	0	0	0	0	400	0	0	0	0	0	0	0	**400**
11	Laptop	3	Development of typical record documentation and communication with partnors and collaborator	C	R	1700	0	0	0	0	0	0	0	0	0	0	0	**1700**
12	Autoclave	1	For sterilization of nutrient medium	C	R	0	0	0	0	2000	0	0	0	0	0	0	0	**2000**
																		0
																		0
Leased Equipment																		
																		0
																		0
Total Costs:						**38400**	**0**	**0**	**0**	**4000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**42400**

Table 5. Materials / Таблиця 5. Матеріали

#	#	Description	Inst.	Anticipated Use	V-Code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total
1		**Raw materials (metals, gases, oils etc)**																**0**
	1.1	Nutrient medium	1	For isolation and investigation of bacteriophaghes	C	1000	0	0	0	1000	0	0	0	0	0	0	0	**2000**
	1.2	Nutrient media	3	For isolation and investigation of Pseudomonas strsains	C	500	0	0	0	500	0	0	0	0	0	0	0	**1000**
	1.3	Nutrient medium	2	For isolation and investigation of Legionella strains	C	1000	0	0	0	4000	0	0	0	0	0	0	0	**5000**
																		0
																		0
2		**Chemicals (reagents, solvents, salts, acids etc);**																**0**
	2.1	Reagents for PFGE	3	For molecular typing of Pseudomonas strains	C	1500	0	0	0	3000	0	0	0	0	0	0	0	**4500**
	2.2	Reagents for PFGE (restrictases,buffers, Proteinase K,Seakem Gold Agarose,Trizma base)	1	For molecular biological characteristics of selected bacteriophages	C	0	0	0	0	3000	0	0	0	0	0	0	0	**3000**
	2.3	Legionella and gram stain Kits . GVPC- agar plates	2	For isentification of Legionella strains	C	500	0	0	0	3000	0	500	0	0	0	0	0	**4000**
	2.4	Geagents for PFGE (restrictases,buffers, Proteinase K,Seakem Gold Agarose,Trizma base)	2	For molecular typing of Legionella strains	C	0	500	0	0	3000	0	3500	0	0	0	0	0	**7000**
																		0
																		0
3		**Laboratory supplies (electronic components, glassware, laboratory tools, photo materials etc);**																**0**
	3.1	Disposable plates, lab coats, Inoculating loops, gloves	3	For conducting experimental investigations	C	500	0	0	0	0	0	0	0	0	0	0	0	**500**
	3.2	Disposable plates, lab coats, Inoculating loops, gloves; Millipore filters	2	For isolation and investigation of Legionella strains	C	500	0	0	0	2000	0	500	0	0	0	0	0	**3000**
	3.3	Accessories for PFGE, Corning Stripette serological pipettes and tips, Falcone tubes, Powder-free latex gloves,polaroid BW films	2	For molecular typing of Legionella	C	0	500	0	0	3185	0	1500	0	0	0	0	0	**5185**
																		0
																		0
4		**Office supplies (stationery and other expendable materials:cartridges, toner, cleaning household goods etc)**																**0**
	4.1	Stationary, cartridges, flash-memory etc.	3	For experinmental results registration	C	0	0	0	0	500	0	500	0	0	0	0	0	**1000**
	4.2	Stationary, cartridges	2	For experinmental results registration	C	0	0	0	0	2000	0	0	0	0	0	0	0	**2000**
																		0
																		0
5		**Other**																**0**
																		0
																		0
					Total Costs:	**5500**	**1000**	**0**	**0**	**25185**	**0**	**6500**	**0**	**0**	**0**	**0**	**0**	**38185**

Table 6. Other Direct Costs / Таблиця 6. Інші прямі витрати

#	#	Description	Inst.	Anticipated Use	V-Code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total
1		**Computer software**																0
	1.1	Computer software	3	For affice works	C	0	0	0	0	200	0	0	0	0	0	0	0	200
																		0
																		0
2		**Communication (Internet, phone, e-mail…)**																0
	2.1	Communications, internet	3	For communication with group members and collaborators	C	300	300	300	300	300	300	300	300	0	0	0	0	2400
	2.2	Electristy, communications, internet	2	For conducting of experiments, communication with group members and collaborators	C	530	500	500	500	500	500	500	500	0	0	0	0	4030
	2.3	Electristy, communications, internet	1	For conducting of experiments, communication with group members and collaborators	C	550	550	530	530	530	530	530	602	0	0	0	0	4352
																		0
																		0
3		**Security**																0
																		0
																		0
4		**Repairing/maintenance of equipment**																0
	4.1	Repearing of equipment	3	For laboratory works	C	0	0	0	0	400	0	0	0	0	0	0	0	400
																		0
																		0
5		**Laboratory tests outside**																0
																		0
																		0
6		**Publications/translation**																0
	6.1	Publication of scientific articles	3	For publication of experimental results	C	0	0	0	0	0	0	600	0	0	0	0	0	600
																		0
																		0
7		**Transportation**																0
																		0
																		0
8		**Patenting**																0
																		0
																		0
9		**Other**																0
																		0
																		0
					Total Costs:	**1380**	**1350**	**1330**	**1330**	**1930**	**1330**	**1930**	**1402**	**0**	**0**	**0**	**0**	**11982**

Table 7. Travel / Таблиця 7. Відрядження

#	Country of Destination	City	Inst.	People	Institute of Destination	Purpose of Travel	V-Code	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total
International																				
1	USA	Boston	1	2	Novophage Inc	Capstone meeting	C	0	0	0	0	0	0	0	4000	0	0	0	0	**4000**
2	USA	Boston	3	2	Novophage Inc	Capstone meeting	C	0	0	0	0	0	0	0	3880	0	0	0	0	**3880**
3	USA	Boston	3	2	Novophage Inc	traning	C	0	4000	0	0	0	0	0	0	0	0	0	0	**4000**
4	USA	Washington	3	1	ASM conference	Attending conference	C	0	0	0	0	2000	0	0	0	0	0	0	0	**2000**
5	USA	Evergreen	1	1	Phage meeting	attending conferense	C	0	0	0	0	0	2000	0	0	0	0	0	0	**2000**
6	USA	Boston	1	1	Novophage Inc	Training	C	0	4000	0	0	0	0	0	0	0	0	0	0	**4000**
7	USA	Washington	2	2	ASM conference	Attending conference	C	0	0	0	0	0	0	0	4000	0	0	0	0	**4000**
8	USA	Boston	2	2	Novophage Inc	traning	C	0	4000	0	0	0	0	0	0	0	0	0	0	**4000**
9	USA	Boston	2	1	Novophage Inc	Capstone meeting	C	0	0	0	0	0	0	0	2500	0	0	0	0	**2500**
																				0
																				0
																				0
						Total International Costs:		**0**	**12000**	**0**	**0**	**2000**	**2000**	**0**	**14380**	**0**	**0**	**0**	**0**	**30380**
Domestic																				
1	Georgia	Tbilisi, Batumi	2	2	Hotels	Collection of samples	C	250	250	250	250	250	250	250	250	0	0	0	0	**2000**
																				0
																				0
																				0
						Total Domestic Costs:		**250**	**250**	**250**	**250**	**250**	**250**	**250**	**250**	**0**	**0**	**0**	**0**	**2000**

Summary	
International:	**30380**
Domestic:	**2000**
Total:	**32380**

Table 8. Financial Summary / Таблиця 8. Зведена фінансова інформація

#	Item	Qtr1	Qtr2	Qtr3	Qtr4	Qtr5	Qtr6	Qtr7	Qtr8	Qtr9	Qtr10	Qtr11	Qtr12
1	Days - FWS	689	689	762	762	774	774	774	776	0	0	0	0
2	Days - NFWS	402	402	456	456	456	456	456	452	0	0	0	0
	Total Days:	1091	1091	1218	1218	1230	1230	1230	1228	0	0	0	0
1	Grants - FWS	27795	27795	30960	30995	31380	31370	31370	31480	0	0	0	0
2	Grants - NFWS	12265	12265	13885	13885	13885	13885	13885	13765	0	0	0	0
3	Grants total:	40060	40060	44845	44880	45265	45255	45255	45245	0	0	0	0
4	Equipment	38400	0	0	0	4000	0	0	0	0	0	0	0
5	Materials	5500	1000	0	0	25185	0	6500	0	0	0	0	0
6	Other Direct Costs	1380	1350	1330	1330	1930	1330	1930	1402	0	0	0	0
7	Travel International	0	12000	0	0	2000	2000	0	14380	0	0	0	0
8	Travel Domestic	250	250	250	250	250	250	250	250	0	0	0	0
9	Travel Total:	250	12250	250	250	2250	2250	250	14630	0	0	0	0
10	Non-Labor Expenses:	45530	14600	1580	1580	33365	3580	8680	16032	0	0	0	0
11	Total Expenses:	85590	54660	46425	46460	78630	48835	53935	61277	0	0	0	0
12	Overhead for the Institution	9876	616	616	616	616	616	616	616	0	0	0	0
13	Tolal Project Cost:	**95 466**	**55 276**	**47 041**	**47 076**	**79 246**	**49 451**	**54 551**	**61 893**	**0**	**0**	**0**	**0**

Overhead for the Institution(s):	2.98
Project duration (quarters):	8

STCU fee - 5%	0	0
STCU fee -0% - *for this case delete 5 in a c*		
Total Project Cost		**490 000**

Table 9. Financial Summary (Cumulative)

#	Item	Qtr1	Qtr2	Qtr3	Qtr4	Qtr5	Qtr6	Qtr7	Qtr8	Qtr9	Qtr10	Qtr11	Qtr12
1	Days - FWS	689	1378	2140	2902	3676	4450	5224	6000	6000	6000	6000	6000
2	Days - NFWS	402	804	1260	1716	2172	2628	3084	3536	3536	3536	3536	3536
	Total Days:	1091	2182	3400	4618	5848	7078	8308	9536	9536	9536	9536	9536
1	Grants - FWS	27795	55590	86550	117545	148925	180295	211665	243145	243145	243145	243145	243145
2	Grants - NFWS	12265	24530	38415	52300	66185	80070	93955	107720	107720	107720	107720	107720
3	Grants total:	40060	80120	124965	169845	215110	260365	305620	350865	350865	350865	350865	350865
4	Equipment	38400	38400	38400	38400	42400	42400	42400	42400	42400	42400	42400	42400
5	Materials	5500	6500	6500	6500	31685	31685	38185	38185	38185	38185	38185	38185
7	Other Direct Costs	1380	2730	4060	5390	7320	8650	10580	11982	11982	11982	11982	11982
8	Travel International	0	12000	12000	12000	14000	16000	16000	30380	30380	30380	30380	30380
9	Travel Domestic	250	500	750	1000	1250	1500	1750	2000	2000	2000	2000	2000
10	Travel Total:	250	12500	12750	13000	15250	17500	17750	32380	32380	32380	32380	32380
11	Non-Labor Expenses:	45530	60130	61710	63290	96655	100235	108915	124947	124947	124947	124947	124947
12	Total Expenses:	85590	140250	186675	233135	311765	360600	414535	475812	475812	475812	475812	475812
13	Overhead for the Institution	9876	10492	11108	11724	12340	12956	13572	14188	14188	14188	14188	14188
14	Tolal Project Cost:	**95 466**	**150 742**	**197 783**	**244 859**	**324 105**	**373 556**	**428 107**	**490 000**	**490 000**	**490 000**	**490 000**	**490 000**

S8. Estimated expenditures by each participating institution /Кошторисні витрати організацій-учасників

G.Eliava Institute of Bacteriophage, Microbiology and Virology													Overhead 0%
#	Item	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total
1	Days - FWS	235	235	308	307	305	304	304	304	0	0	0	0	2302
2	Days - NFWS	133	133	187	187	187	187	187	183	0	0	0	0	1384
	Total Days:	368	368	495	494	492	491	491	487	0	0	0	0	3686
1	Grants - FWS	9225	9225	12390	12355	12285	12240	12240	12240	0	0	0	0	92200
2	Grants - NFWS	3990	3990	5610	5610	5610	5610	5610	5490	0	0	0	0	41520
3	Grants total:	13215	13215	18000	17965	17895	17850	17850	17730	0	0	0	0	133720
4	Equipment	4000	0	0	0	2000	0	0	0	0	0	0	0	6000
5	Materials	1000	0	0	0	4000	0	0	0	0	0	0	0	5000
6	OtherDirectCosts	550	550	530	530	530	530	530	602	0	0	0	0	4352
7	Travel International	0	4000	0	0	0	2000	0	4000	0	0	0	0	10000
8	Travel Domestic	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Travel Total:	0	4000	0	0	0	2000	0	4000	0	0	0	0	10000
10	Non-Labor Expenses	5550	4550	530	530	6530	2530	530	4602	0	0	0	0	25352
11	Total Expenses	18765	17765	18530	18495	24425	20380	18380	22332	0	0	0	0	159072
12	Overhead	616	616	616	616	616	616	616	616	0	0	0	0	4928
13	Total project cost	19381	18381	19146	19111	25041	20996	18996	22948	0	0	0	0	164000

National Center for Disease Control of Georgia													Overhead 0%
#	Item	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total
1	Days - FWS	247	247	247	247	262	263	263	264	0	0	0	0	2040
2	Days - NFWS	116	116	116	116	116	116	116	116	0	0	0	0	928
	Total Days:	363	363	363	363	378	379	379	380	0	0	0	0	2968
1	Grants - FWS	9770	9770	9770	9770	10295	10330	10330	10370	0	0	0	0	80405
2	Grants - NFWS	4060	4060	4060	4060	4060	4060	4060	4060	0	0	0	0	32480
3	Grants total:	13830	13830	13830	13830	14355	14390	14390	14430	0	0	0	0	112885
4	Equipment	1000	0	0	0	2000	0	0	0	0	0	0	0	3000
5	Materials	2000	1000	0	0	17185	0	6000	0	0	0	0	0	26185
6	OtherDirectCosts	530	500	500	500	500	500	500	500	0	0	0	0	4030
7	Travel International	0	4000	0	0	0	0	0	6500	0	0	0	0	10500
8	Travel Domestic	250	250	250	250	250	250	250	250	0	0	0	0	2000
9	Travel Total:	250	4250	250	250	250	250	250	6750	0	0	0	0	12500
10	Non-Labor Expenses	3780	5750	750	750	19935	750	6750	7250	0	0	0	0	45715
11	Total Expenses	17610	19580	14580	14580	34290	15140	21140	21680	0	0	0	0	158600
12	Overhead	4400	0	0	0	0	0	0	0	0	0	0	0	4400
13	Total project cost	22010	19580	14580	14580	34290	15140	21140	21680	0	0	0	0	163000

National Center of Tuberculosis and Lung Diseases													Overhead 0%
#	Item	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total
1	Days - FWS	207	207	207	208	207	207	207	208	0	0	0	0	1658
2	Days - NFWS	153	153	153	153	153	153	153	153	0	0	0	0	1224
	Total Days:	360	360	360	361	360	360	360	361	0	0	0	0	2882
1	Grants - FWS	8800	8800	8800	8870	8800	8800	8800	8870	0	0	0	0	70540
2	Grants - NFWS	4215	4215	4215	4215	4215	4215	4215	4215	0	0	0	0	33720
3	Grants total:	13015	13015	13015	13085	13015	13015	13015	13085	0	0	0	0	104260
4	Equipment	33400	0	0	0	0	0	0	0	0	0	0	0	33400
5	Materials	2500	0	0	0	4000	0	500	0	0	0	0	0	7000
6	OtherDirectCosts	300	300	300	300	900	300	900	300	0	0	0	0	3600
7	Travel International	0	4000	0	0	2000	0	0	3880	0	0	0	0	9880
8	Travel Domestic	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Travel Total:	0	4000	0	0	2000	0	0	3880	0	0	0	0	9880
10	Non-Labor Expenses	36200	4300	300	300	6900	300	1400	4180	0	0	0	0	53880
11	Total Expenses	49215	17315	13315	13385	19915	13315	14415	17265	0	0	0	0	158140
12	Overhead	4860	0	0	0	0	0	0	0	0	0	0	0	4860
13	Total project cost	54075	17315	13315	13385	19915	13315	14415	17265	0	0	0	0	163000

#	Item	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Total
1	Days - FWS	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Days - NFWS	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Days:	0	0	0	0	0	0	0	0	0	0	0	0	0
1	Grants - FWS	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Grants - NFWS	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Grants total:	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Materials	0	0	0	0	0	0	0	0	0	0	0	0	0
6	OtherDirectCosts	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Travel International	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Travel Domestic	0	0	0	0	0	0	0	0	0	0	0	0	0
9	Travel Total:	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Non-Labor Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Total Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Overhead	0	0	0	0	0	0	0	0	0	0	0	0	0
13	Total project cost	0	0	0	0	0	0	0	0	0	0	0	0	0

Table S9. Cumulative expenditures by each participating institution / Витрати організацій-учасників із зростаючим підсумком

G.Eliava Institute of Bacteriophage, Microbiology and Virology													
#	Item	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
1	Days - FWS	235	470	778	1085	1390	1694	1998	2302	2302	2302	2302	2302
2	Days - NFWS	133	266	453	640	827	1014	1201	1384	1384	1384	1384	1384
	Total Days:	368	736	1231	1725	2217	2708	3199	3686	3686	3686	3686	3686
1	Grants - FWS	9225	18450	30840	43195	55480	67720	79960	92200	92200	92200	92200	92200
2	Grants - NFWS	3990	7980	13590	19200	24810	30420	36030	41520	41520	41520	41520	41520
3	Grants total:	13215	26430	44430	62395	80290	98140	115990	133720	133720	133720	133720	133720
4	Equipment	4000	4000	4000	4000	6000	6000	6000	6000	6000	6000	6000	6000
5	Materials	1000	1000	1000	1000	5000	5000	5000	5000	5000	5000	5000	5000
6	OtherDirectCosts	550	1100	1630	2160	2690	3220	3750	4352	4352	4352	4352	4352
7	Travel International	0	4000	4000	4000	4000	6000	6000	10000	10000	10000	10000	10000
8	Travel Domestic	0	0	0	0	0	0	0	0	0	0	0	0
9	Travel Total:	0	4000	4000	4000	4000	6000	6000	10000	10000	10000	10000	10000
10	Non-Labor Expenses	5550	10100	10630	11160	17690	20220	20750	25352	25352	25352	25352	25352
11	Total Expenses	18765	36530	55060	73555	97980	118360	136740	159072	159072	159072	159072	159072
12	Overhead	616	1232	1848	2464	3080	3696	4312	4928	4928	4928	4928	4928
13	Total project cost	**19381**	**37762**	**56908**	**76019**	**101060**	**122056**	**141052**	**164000**	**164000**	**164000**	**164000**	**164000**

National Center for Disease Control of Georgia													
#	Item	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
1	Days - FWS	247	494	741	988	1250	1513	1776	2040	2040	2040	2040	2040
2	Days - NFWS	116	232	348	464	580	696	812	928	928	928	928	928
	Total Days:	363	726	1089	1452	1830	2209	2588	2968	2968	2968	2968	2968
1	Grants - FWS	9770	19540	29310	39080	49375	59705	70035	80405	80405	80405	80405	80405
2	Grants - NFWS	4060	8120	12180	16240	20300	24360	28420	32480	32480	32480	32480	32480
3	Grants total:	13830	27660	41490	55320	69675	84065	98455	112885	112885	112885	112885	112885
4	Equipment	1000	1000	1000	1000	3000	3000	3000	3000	3000	3000	3000	3000
5	Materials	2000	3000	3000	3000	20185	20185	26185	26185	26185	26185	26185	26185
6	OtherDirectCosts	530	1030	1530	2030	2530	3030	3530	4030	4030	4030	4030	4030
7	Travel International	0	4000	4000	4000	4000	4000	4000	10500	10500	10500	10500	10500
8	Travel Domestic	250	500	750	1000	1250	1500	1750	2000	2000	2000	2000	2000
9	Travel Total:	250	4500	4750	5000	5250	5500	5750	12500	12500	12500	12500	12500
10	Non-Labor Expenses	3780	9530	10280	11030	30965	31715	38465	45715	45715	45715	45715	45715
11	Total Expenses	17610	37190	51770	66350	100640	115780	136920	158600	158600	158600	158600	158600
12	Overhead	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400	4400
13	Total project cost	**22010**	**41590**	**56170**	**70750**	**105040**	**120180**	**141320**	**163000**	**163000**	**163000**	**163000**	**163000**

National Center of Tuberculosis and Lung Diseases													
#	Item	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
1	Days - FWS	207	414	621	829	1036	1243	1450	1658	1658	1658	1658	1658
2	Days - NFWS	153	306	459	612	765	918	1071	1224	1224	1224	1224	1224
	Total Days:	360	720	1080	1441	1801	2161	2521	2882	2882	2882	2882	2882
1	Grants - FWS	8800	17600	26400	35270	44070	52870	61670	70540	70540	70540	70540	70540
2	Grants - NFWS	4215	8430	12645	16860	21075	25290	29505	33720	33720	33720	33720	33720
3	Grants total:	13015	26030	39045	52130	65145	78160	91175	104260	104260	104260	104260	104260
4	Equipment	33400	33400	33400	33400	33400	33400	33400	33400	33400	33400	33400	33400
5	Materials	2500	2500	2500	2500	6500	6500	7000	7000	7000	7000	7000	7000
6	OtherDirectCosts	300	600	900	1200	2100	2400	3300	3600	3600	3600	3600	3600
7	Travel International	0	4000	4000	4000	6000	6000	6000	9880	9880	9880	9880	9880
8	Travel Domestic	0	0	0	0	0	0	0	0	0	0	0	0
9	Travel Total:	0	4000	4000	4000	6000	6000	6000	9880	9880	9880	9880	9880
10	Non-Labor Expenses	36200	40500	40800	41100	48000	48300	49700	53880	53880	53880	53880	53880
11	Total Expenses	49215	66530	79845	93230	113145	126460	140875	158140	158140	158140	158140	158140
12	Overhead	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860	4860
13	Total project cost	**54075**	**71390**	**84705**	**98090**	**118005**	**131320**	**145735**	**163000**	**163000**	**163000**	**163000**	**163000**

0													
#	Item	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
1	Days - FWS	0	0	0	0	0	0	0	0	0	0	0	0
2	Days - NFWS	0	0	0	0	0	0	0	0	0	0	0	0
	Total Days:	0	0	0	0	0	0	0	0	0	0	0	0
1	Grants - FWS	0	0	0	0	0	0	0	0	0	0	0	0
2	Grants - NFWS	0	0	0	0	0	0	0	0	0	0	0	0
3	Grants total:	0	0	0	0	0	0	0	0	0	0	0	0
4	Equipment	0	0	0	0	0	0	0	0	0	0	0	0
5	Materials	0	0	0	0	0	0	0	0	0	0	0	0
6	OtherDirectCosts	0	0	0	0	0	0	0	0	0	0	0	0
7	Travel International	0	0	0	0	0	0	0	0	0	0	0	0
8	Travel Domestic	0	0	0	0	0	0	0	0	0	0	0	0
9	Travel Total:	0	0	0	0	0	0	0	0	0	0	0	0
10	Non-Labor Expenses	0	0	0	0	0	0	0	0	0	0	0	0
11	Total Expenses	0	0	0	0	0	0	0	0	0	0	0	0
12	Overhead	0	0	0	0	0	0	0	0	0	0	0	0
13	Total project cost	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Table 10. List of Personnel

Emp. Number	Number in Project	Surname (RU)	First Name (RU)	Second Name (RU)	Surname (EN)	Name (EN)	Passport Number	Project Number	Bank Account Number	Bank ID	Category Number	Advance	% of participation	Daily Rate	Tax ID Number	I-Code	Position at the organization	Participation in other STCU projects	state project numbers and % of participation
	1	Габисония	Тараси	Гиви	Gabisonia	Tarasi	G-0376955	P496	GE63VT6800000010093611	1	1	583	62	70		1	Head of Laboratory	Yes	Ge-130, 3387, p-395
	2	Лаладзе	Манана	Жиули	Loladze	Manana	A-1388495	P496	GE41VT6800000044483611	1	1	480	83	45		1	Head of Laboratory	Yes	Ge-130, 3387, p-395
	3	Чанишвили	Ламара	Григол	Chanishvili	Lamara	D-0602355	P496	GE24VT6800000010873611	1	1	292	64	35		1	Researcher	Yes	3387, p-395
	4	Чахунашвили	Натела	Константинович	Chakhunashvili	Natela	G-0612288	P496	GE57VT6800000010213611	1	1	292	64	35		1	Senior Researcher	Yes	3387, p-395
	5	Надирадзе	Манана	Михаил	Nadiradze	Manana	B-0608859	P496	GE61VT6800000227413611	1	1	292	63	35		1	Researcher	Yes	p-395
	6	Турмнидзеа	Цицино	Симон	Turmanidze	Tsitsino	B-0532060	P496	GE31VT6600003180703611	1	1	327	51	35		1	Senior Researcher	Yes	Ge-130
	7	Алибегашвили	Маия	Гиви	Alibegashvili	Maia	B-1255521	P496	GE09VT7000000214863611	1	1	420	65	35		1	Researcher	Yes	Ge-130
	8	Гиоргадзе	Марине	Вахтанг	Georgadze	Marine	G-1412012	P496	GE30VT6500000001553611	1	1	390	71	30		1	Researcher	No	
	9	Дидебулидзе	Каха	Автандил	Didebulidze	Kakha	G-0954164	P496	GE28VT6800000038923611	1	2	250	82	30		1	Researcher	Yes	Ge-130, 3387, p-395
	10	Мелашвили	Гиорги	Соломон	Melashvili	Giorgi	G-1232828	P496	GE56VT6800000039333611	1	2	250	82	30		1	Researcher	Yes	Ge-130, 3387, p-395
	11	Патаридзе	Ирина	Омар	Pataridze	Irina	D-1361979	P496	GE47VT6600000044373611	1	2	450	82	30		1	Researcher	Yes	3387
	12	Кочламазишвили	Кетеван	Серго	Kochlamazashvili	Ketevan	B-1163650	P496	GE25VT6600000289253611	1	2	380	69	30		1	Researcher	No	
	13	Мгеладзе	Гела	Лури	Mgeladze	Gela	B-0007295	P496	GE41VT7000000000823611	1	1	480	58	45		2	Head of Biosecurity and Biosafety Unit	No	
	14	Кацитадзе	Гурам	Константин	Katsitadze	Guram	G 0710959	P496	GE07VT7000000059703611	1	1	333	45	40	-	2	Member of Science Council	Yes	P-322
	15	Церцвадзе	Николоз	Серго	Tsertsvadze	Nikiloz	A-0980507	P496	GE54VT7000000159223601	1	1	333	45	40		2	Head of Especially Dangerous Infections Department	No	
	16	Цанава	Шота	Алекси	Tsanava	Shota	D-0443488	P496	GE20VT6600000305843611	1	1	375	45	45		2	Head of Department	No	
	17	Имнадзе	Паата	Гиви	Imnadze	Paata	A-0093049	P496	GE40VT7000000061953611	1	1	347	48	40		2	Head of Scientific Council	Yes	P-322
	18	Грдзелидзе	Марина	Гиорги	Grdzelidze	Marina	B 0113931	P496	GE46VT7000000111853601	1	1	467	64	40	-	2	Leading Researcher	No	
	19	Мирианашвили	Зураб	Отари	Mirianashvili	Zurab	D-0447224	P496	GE02VT7000000005063601	1	1	350	55	35		2	Head of Seroepidemiological Unit	No	
	20	Чубинидз	Светлана	Александре	Chubinidze	Svetlana	B-0213101	P496	GE04VT7000000116573601	1	1	373	58	35		2	Senior Specialist	No	
	21	Чантурия	Гванца	Сосо	Chanturia	Gvantsa	D-0176723	P496	GE37VT1000000916094516	1	1	198	45	35		2	Chief Specialist	No	
	22	Датукишвили	Софио	Гиви	Datukishvili	Sophio	B-0255724	P496	GE76VT7000000716533601	1	2	350	55	35		2	Specialist	No	
	23	маладзе	Екатерине	Иракли	Khmaladze	Ekaterine	A-0532344	P496	GE54VT7000000004993601	1	2	327	51	35		2	Specialist	No	
	24	Пирцхалаишвили	Гиорги	Отари	Pirtskhalaishvili	Giorgi	G-1101150	P496	GE78VT7000000716493601	1	2	350	55	35		2	Specialist	No	
	25	Кометиани	Тевдоре	Сосо	Kometiani	Tevdore	A-1385949	P496	GE81VT7000000127643601	1	2	327	51	35		2	Leading Specialist	No	
	26	Вашакидзе	Серго	Александре	Vashakidze	Sergo	A-0348427	P496	GE35VT7000000001913611	1	1	917	100	50		3	Surgery Coordinator	No	
	27	Шубладзе	Наталия	Фридон	Shubladze	Natalia	E-0012805	P496	GE28VT7000000022321311	1	1	810	98	45		3	Senior Researcher	Yes	
	28	Купреишвили	Лали	Гиорги	Kupreishvili	Lali	B-0516194	P496	GE31VT0400107303303601	1	1	570	82	38		3	Physician	No	
	29	Каландадзе	Иагор	Леварси	Kalandadze	Iagor	G-0181718	P496	GE52VT1000000199514506	1	1	187	15	70		3	Director	Yes	
	30	Ахалаия	Мака	Даниел	Akhalaia	Maka	B-0215131	P496	GE88VT6500000001363611	1	1	450	82	30		3	Micribiologist	No	

	31	Ревишвили	Надежда	Варлам	Revishvil	Nadezhda	D-1321685	P496	GE27VT6500000002163601	1	2	333	73	25		3	Microbiologist	No	
	32	Доквадзе	Нана	Вахтанг	Dokvadze	Nana	D-1069683	P496	GE84VT6500000010173611	1	2	292	64	25		3	Lab technician	No	
	33	Баблишвили	Нино	Константин	Bablishvili	Nino	B-0542753	P496	GE18VT6500005401783611	1	2	390	71	30		3	Researcher	No	
	34	Тадумадзе	Нона	Автандил	Tadumadze	Nona	D-0578767	P496	GE85VT6500000001423611	1	2	390	71	30		3	Researcher	Yes	
										Total grant advance:		**13355**							

1 JSC VTB Bank Georgia (VTB)
37, D. Uznadze st, Tbilisi(0102) , Georgia

Bank Info

MFO	UGEBGE22
ZKPO	None given
Transit Number	4354511

Annex 2 - Financial Provisions

Article 1 - Allowable Costs

1.1 Costs shall include actual costs incurred for the Project after the operative commencement date which are necessary for the performance of the project. Allowable costs may only include the cost categories defined in Articles 2 and 3 of this annex.

1.2 The original estimates of expenditures set forth in Annex I may be adjusted by the project manager between categories in consultation with the Center and Partner, and provided that the transfers do not fundamentally alter the scope or content of the project.

Article 2 - Direct Costs

2.1 Personnel

2.1.1 Personnel costs may be charged to the project as direct costs.

2.1.2 The institution and the project manager are responsible for certifying the times devoted to the Project by the individual participants, as reflected in project time cards prepared by individual participants. Personnel costs charged to the Project shall be in increments of one hour.

2.1.3 The project manager may increase the time commitments of personnel by up to 10 percent during one quarter of any individual without approval of the Center but may not change the daily rate without approval of the Center. The project manager may request more significant changes in personnel commitments, including changes in the names of personnel, at the beginning of each quarter. Such significant changes must be fully justified in writing. Changes in scientific personnel must provide for the new individual participants to have technical credentials and previous weapons experience comparable to those of the individual participants they replace. The Center, in consultation with the Partner, will respond promptly to such requests.

2.1.4 The Center will not pay personnel costs associated with holidays, vacations, overtime, or sick leave. Such additional costs, if any, are the responsibility of the Recipient(s).

2.1.5 Since the individual participants will remain employees of the institution, the Center's act of direct grant payments to the individual participants will not transfer from the Recipient(s) to the Center any liability for damages caused by the individual participants during execution of the projects or any liability for damages to the individual participants during execution of the Project.

2.1.6 The Recipient(s) is responsible for any medical expenses or compensation claims for injuries or other losses for personnel working on the project which are directly or indirectly related to the project.

2.1.7 Individual participants must personally record the hours worked on STCU projects on time cards according to the following procedures:

Project Manager and Participating Institution Manager Responsibilities

Project managers and Participating Institution Managers are required to do the following:

i. Provide project participants with a separate time card for each STCU project that they will work on. Each time card must contain a project number.
ii. Ensure that project participants understand which time card must be used to record hours worked on each project.
iii. Ensure that all project participants correctly record the hours worked on STCU projects according to the procedure described in the project participant responsibilities section below.
iv. Transmit completed time cards to the STCU no later than the 10th of each month.
v. Control blank time cards provided by the STCU.
vi. Certify that the hours recorded on the time cards are true and accurate by signing them.
vii. Obtain signatures of two other project participants on their own (project managers' and participating institution managers') time cards in addition to their own signature.

Project Participant Responsibilities

Project participants are required to do the following:

i. Complete a separate time card for each STCU project that they work on. Time cards are for a period of one month.
ii. Personally complete their time cards **each working day** and **in ink**.

iii. Correct time cards by crossing out mistakes and inserting the correct information on the next line; no erasures may be made to time cards. Project workers must initial the corrections.
iv. Sign their own time cards at the end of each month.
v. Certify, on an as needed basis, that the hours recorded on the time cards of the project manager or participating institution manager are true and accurate by signing their cards.

2.1.8 Payments to individual participants will be based on properly completed time cards as described in Section 2.1.7 above

2.1.9 The Center will provide blank time cards for use on this project. Such time cards will be printed on card stock and will be serially numbered. Only time cards provided by the Center may be used to record hours worked on STCU projects; photocopied time cards are not acceptable.

2.1.10 Project participation is limited as described in the STCU Standard Operating Procedure XXIV – Project Participation in STCU Projects: A copy of the this procedure may be obtained on the STCU's website at the following address: http://www.stcu.int/documents/reports/financial/.

2.2 Equipment

2.2.1 The cost of equipment used in the project which is purchased, fabricated, or leased may be charged to the Project as a direct cost. The total lease costs may not exceed the purchase price of the equipment.

2.2.2 Equipment purchased in accordance with Article 3.3 of the Agreement will be preserved, accounted for, and maintained throughout the term of the Project by the Recipient(s).

2.2.3 . Equipment purchased for the project should be identified as described in the STCU Standard Operating Procedure XXIII - Identification Of Equipment Purchased For Stcu Projects. A copy of the this procedure may be obtained on the STCU's website at the following address: http://www.stcu.int/documents/reports/financial/.

2.3 Materials

The costs of materials required for the Project shall be allowable costs.

2.4 Services and Other direct costs

2.4.1 Costs associated with (1) testing facilities, (2) computer services, (3) communication, (4) security services, (5) repairing/maintenance of equipment, (6) laboratory tests outside, (7) publications, and (8) patenting, but excluding items covered by Article 4 of Annex 2, may be charged as direct costs to the project through cost allocation formulas approved by the Center, provided such facilities and services contribute to the project and are accessible for monitoring and auditing in accordance with Article 9 of this agreement.

2.5 Travel and per diem

The following travel costs may be charged to the project:

i. Airline Tickets. Reimbursement is limited to the cost of coach or economy class airfare by the most direct, cost-effective routing.
ii. Train Tickets. Reimbursement for first class rail fare is authorized.
iii. Lodging.
    A. Within Country of Residence, reimbursement is limited to the lower of the actual cost or $100.00 (taxes not included) per day.
    B. Outside Country of Residence, reimbursement is limited to the lower of the actual cost or the maximum amount allowed in the U.S. Joint Travel Regulations (taxes not included). If lodging is pre-arranged for the traveler because of conference participation funded by the STCU, then the maximum amount allowed in the U.S. Joint Travel Regulations may be exceeded by up to 25% (taxes not included). In those exceptional cases where there are no accommodations available within the maximum amount allowed or accommodations are unacceptable, then the most cost-effective accommodation is authorized with prior approval of the responsible Deputy Executive Director. Maximum lodging rates outside of a country of

residence may be obtained from the STCU treasurer or at http://www.state.gov/m/a/als/prdm/xxxx[1]

C. Lodging without receipt is not compensated.

iv. Meals and Incidental Expenses (M&IE).
   1. Within Country of Residence, the M&IE is $35.00 per day.
   2. Outside Country of Residence, the M&IE is $50.00 per day.

v. Other Costs. Actual cost of passports, visa, or conference registration is authorized with receipt. Withdrawal fees accepted by the STCU.

vi. Use of Privately Owned Vehicle. Reimbursement for the use of a privately owned vehicle to perform travel is authorized at the rate of $.10 per kilometer. Records must be kept for this activity, including destination and kilometers traveled, and odometer readings. Documents must be signed and approved by project manager.

vii. Local Travel. Reimbursement for the actual cost of local travel (taxi, bus, etc.) is authorized. Receipts must be obtained.

2.5.1 Additional Travel and per diem information is contained in STCU Standard Operating Procedure V – Project Participants Travel. A copy of the this procedure may be obtained on the STCU's website at the following address: http://www.stcu.int/documents/reports/financial/.

Article 3 - Overhead

3.1 A fixed amount may be charged for project overhead to cover the cost of such items as general administration, institutional management, depreciation of buildings and equipment, maintenance, utilities, staff training or any other cost at discretion of the institute management.

3.2 The total fixed amount may not exceed 10 percent of total direct costs, exclusive of the cost of items provided in-kind by the Center.

3.3 One half of the direct overhead costs will be retained by the Center until project completion.

.Article 4 - Costs not Allowed

4.1 Allowable costs shall not include: profit; contributions to pension, medical, or other social funds; provisions for possible future losses or liabilities; taxes, including profit tax, value added tax, personal income tax, local taxes, tariffs, dues, customs duties, import duties, or others; and costs allocable to another project.

Article 5 - Cash Payments by the Center

5.1 Within Ukraine, all cash payments will be made in the national currency of Ukraine. Conversion of US dollars or Euro to the national currency of Ukraine will be according to the exchange rate of the Interbank Rate of Ukraine. Within Azerbaijan, Georgia, Uzbekistan, and Moldova all cash payment will be made in U.S. Dollars or Euros where possible. The Center shall pay its financial contribution through special bank accounts established.

5.2 The Center shall pay the following financial contribution:

(a) An advance payment, which is one third of the first quarter grant payment to the project grantees, as soon as possible following the operative commencement date;

(b) Quarterly grant payments after approval by the Center of the cost statement for the last completed quarter and, upon Partner's request, after approval by the Partner the quarterly progress report.

(c) Pursuant to Article 3.4, the Center shall make payments of overhead to the participating institutions represented by their respective directors as a fixed payment. One half of the allowable overhead will be paid to the Recipient(s) represented by its director after approval of progress and cost reports. Retention shall be made by the Center of 50% of the allowable overhead for the Recipient(s). The retention shall be released to the Recipient(s) represented by its director within one month following the approval by the Center of the last technical or financial document or other deliverable required by the Agreement.

(d) Current payments directly to vendors in amounts, which are estimated in Annex 1. Such payments shall be based on vendor invoices and other documents delivered to the Center with written requests from the project manager.

[1] Where "xxxx" is the year the travel will begin. For example: 2004.

5.3 The Center shall make grant payments directly to private bank accounts of the project grantees in accordance (1) with Letters of agreement between the Center and with each project grantee and (2) payment level rates set forth in Annex 1 and the amount of time devoted to the project by each grantee as certified by the project manager.

5.4 If the Center considers that the work has not effectively been commenced within three months of the payment of the first advance, the Center may require the reimbursement of the advance, together with any interest earned on the advance.

5.5 If on completion or termination of the work, the payments made by the Center exceed the actual allowable costs, the Recipient(s) shall promptly reimburse the difference to the Center. Interest may be added to this amount at the prevailing market rate as determined by the Center one month after the reimbursement date specified by the Center. Any reimbursements and the unspent portion of the Total Cost of the Project will be returned to the Partner account.

5.6 When the suspension becomes effective, the Center shall pay grants to the individual participants for the period they were engaged in the Project before the Center's declaration of suspension becomes effective. Any other payments to the Recipient(s) shall in principle be suspended as long as the suspension remains in effect.

5.7 If the Project is terminated, costs shall be limited to the allowable costs incurred by the Recipient(s) prior to the suspension and other costs which the Center considers to be fair and reasonable having regard to commitments which have been reasonably entered into and which cannot be canceled or avoided.

Article 6 - Project Accounting

The Recipient(s) shall maintain financial documentation, such as invoices, shipping documents and copies of time cards to support and justify the costs reported.

Article 7 - Timing of Financing

7.1 Funds will be disbursed when the partner has deposited the specified amount of its funding commitment to the partner activity, including the STCU fee. Funds are to be deposited in US dollars or Euro in the following account:

Commitment in USD:
Deutsche Bank Trust Company Americas, New York
Partner Contribution Account #04-406-956
Fedwire ABA #021001033
SWIFT BIC: BKTRUS33

Commitment in Euro:
Fortis Bank, Montagne du Park 3, B-1000 Brussels, Belgium
Account No. 210-0777641-44
IBAN: BE55 2100 7776 4144
SWIFT: GEBABEBB

7.2 Interest earned on partner funds will be retained by the STCU.

7.3 Partner will deposit its commitment in accordance with the following schedule

Payment	Due Date	Commitment to the total cost of the project	STCU fee	Total commitment
First payment	Before the Operative Commencement Date	245,000 USD	0	245,000 USD
Second Payment	Before the second year	245,000 USD		245,000 USD
Total		490,000 USD		490,000 USD

Annex 3 - Reports

Article 1 - Cost Statements

1.1. Quarterly cost statements covering each three-month period following the operative commencement date shall be submitted to the Center within 20 days after the end of each reporting period. The format for cost statements will be provided by the Center.

1.2 A consolidated cost statement shall be submitted by the recipient to the Partner and the Center within two months of the completion, cessation, or termination of the work financed by the Partner.

If such a statement is not submitted on time, the Center or the Partner may request in writing its submission. If the Center and the Partner do not receive the submission within thirty-days after such a written request, the Center, in consultation with the Partner, may consider the previously claimed costs to be final and determine to make no further reimbursement.

Article 2 - Reports

2.1 The Recipient shall submit the following reports:

(a) Quarterly progress reports covering each three-month period following the operative commencement date shall be submitted to the Center, to the Partner and/or to the Technical Monitor in accordance with Article 4 within one month after the end of each reporting period. The format for progress report will be provided by the Center.

(b) Technical reports, requested by the Partner, containing a description of the significant results according to the deliverables determined in the Annex I – Work Plan, to be submitted to the Partner and/or to the Technical Monitor within one month after significant results are achieved.

(c) A final report covering all the work, the objectives, the results, and the conclusions, including a suitable summary of all these aspects shall be submitted to the Partner and/or to the Technical Monitor within two months of the completion of the Project work plan or termination of the Agreement, or the agreed completion date of the Agreement, whichever is the earliest. A suitable unrestricted summary of the final report shall be submitted to the Center.

2.2 It is the responsibility of the Recipient, in consultation with the Partner and/or with the Technical Monitor/, to indicate clearly what parts of reports contain invention or business confidential information and specify any limitations on circulation. For each report, an unrestricted version shall also be provided. All reports containing invention or business confidential information shall be handled by the Center according to established internal procedures

2.3 The Recipient shall submit any additional reports or any other deliverables requested by the Partner and/or by the Technical Monitor and specified in Annex 1.

Annex 4 – Intellectual Property

I. NOTICE AND ASSISTANCE REGARDING PATENT AND COPYRIGHT INFRINGEMENT.

Recipient shall report to the Partner, promptly and in reasonable written detail, each notice or claim of patent or copyright infringement based on the performance of this Project Agreement of which Recipient has knowledge and shall furnish to the Partner, at the expense of the Partner, when requested by the Partner, all evidence and information in possession of Recipient pertaining to such claim or any resulting suit.

II. PATENT RIGHTS.

(a) Definitions

(1) "Subject Invention" means any invention or discovery of Recipient conceived or first actually reduced to practice in the performance of work under this Project Agreement.

(2) "Patent Counsel" means the U.S. Department of Energy (DOE) Patent Counsel assisting the Partner.

(b) Invention disclosures and reports

(1) Recipient shall furnish Center, the Technical Monitor, and Patent Counsel:

(i) A written report containing full and complete technical information concerning each Subject Invention within two months after conception or first actual reduction to practice, whichever occurs first, in the course of or under this Agreement, but in any event prior to any on sale, public use, or public disclosure of such invention known to Recipient. The report shall identify the Project Agreement and inventor and shall be sufficiently complete in technical detail and appropriately illustrated by sketch or diagram to convey to one skilled in the art to which the invention pertains a clear understanding of the nature, purpose, operation, and to the extent known, the physical, chemical, biological, or electrical characteristics of the invention.

(ii) Upon request, but not more than annually, interim reports on a DOE approved form listing Subject Inventions for that period and certifying that all Subject Inventions have been disclosed or that there were no such inventions; and

(iii) A final report on a DOE-approved form within 3 months after completion of the Project Agreement work listing all Subject Inventions and certifying that all Subject Inventions have been disclosed or that there were no such inventions.

(2) Recipient agrees that the U.S. Government and the Technical Monitor may duplicate and disclose Subject Invention disclosures and all other reports and papers furnished or required to be furnished pursuant to this Project Agreement.

(c) Rights to Subject Inventions

(1) In accordance with the STCU Statute, all rights worldwide to Subject Inventions belong to the Recipient. The Recipient and the Partner have agreed to protect and allocate such Subject Inventions as specified in paragraph (c)(2) below.

(2) The Recipient has title to Subject Inventions in the New Independent States. Recipient hereby grants to the Technical Monitor the entire right, title and interest

to Subject Inventions in all countries other than the New Independent States. Recipient acknowledges the right of the Technical Monitor to file applications and execute all documents necessary to obtain patents in said countries. Subject Inventions jointly made by Recipient and the Technical Monitor shall be jointly owned.

(3) Recipient acknowledges that Partner may obtain title to each Subject Invention for which a patent application or applications are not filed by Recipient or the Technical Monitor and for which any issued patents are not maintained by Recipient and the Technical Monitor. To the extent that Partner acquires title to a Subject Invention, Recipient agrees to take such actions and execute all appropriate documents (at no expense to Recipient) to enable Partner to file, prosecute and maintain patent applications thereon.

(4) Recipient acknowledges that the U.S. Government retains a non-exclusive, nontransferable, irrevocable, paid-up license to practice or to have practiced by or on behalf of the U. S. Government every Subject Invention throughout the world.

(5) Recipient certifies that it has not entered, and will not enter**,** into an agreement with a third party that conflicts with this Project Agreement. To the extent that any subsequent agreement between Recipient and a third party conflicts with the allocation of rights in Subject Inventions under this Project Agreement, Recipient agrees that the terms of the Project Agreement will supersede the terms of the subsequent agreement.

(d) Publication

In order that information concerning scientific or technical developments conceived or first actually reduced to practice in the course of or under the Agreement is not prematurely published so as to adversely affect patent interests of the Technical Monitor, Recipient agrees to submit to the Technical Monitor for patent review a copy of each paper 60 days prior to its intended publication date. Recipient may publish such information after a 60-day period following such submission or prior thereto if specifically approved by the Technical Monitor, unless Recipient is informed in writing within the 60-day period, that in order to protect patentable subject matter, publication must further be delayed. In this event, publication shall be delayed up to 100 days beyond the 60-day period or such longer period as mutually agreed.

(e) Royalty Sharing

To the extent that the Technical Monitor licenses any Subject Invention to a third party which results in income therefrom, Recipient and the Technical Monitor will share the net income therefrom fifty percent (50%) to Recipient and fifty percent (50%) to the Technical Monitor. Net income is gross income less any expenses and costs associated with the licensing of a Subject Invention including, but not limited to, the cost of preparing, prosecuting and maintaining patents covering said Subject Inventions. The Technical Monitor will provide to Recipient annual reports setting forth the licensing activity for Subject Inventions by the Technical Monitor during the reporting period. The Technical Monitor will provide that any agreement to license a Subject Invention will be subject to the royalty sharing arrangement between the Technical Monitor and Recipient

(f) Employee Agreements

Recipient shall obtain agreements to effectuate the provisions of this Patent Rights clause from all persons in its employ who perform any part of the work under this Project Agreement except non-technical personnel, such as clerical employees and manual laborers.

III. RIGHTS IN DATA - GENERAL

(a) Definitions

(1) "Computer software," as used in this clause, means computer programs, computer databases, and documentation thereof.

(2) "Data," as used in this clause, means recorded information, regardless of form or the media on which it may be recorded. The term includes technical data and computer software. The term does not include information incidental to contract administration, such as financial, administrative, cost or pricing, or management information.

(3) "Form, fit, and function data," as used in this clause, means data relating to items, components, or processes that are sufficient to enable physical and functional interchangeability, as well as data identifying source, size, configuration, mating, and attachment characteristics, functional characteristics, and performance requirements; except that for computer software it means data identifying source, functional characteristics, and performance requirements but specifically excludes the source code, algorithm, process, formulae, and flow charts of the software.

(4) "Limited rights data," as used in this clause, means data (other than computer software) developed at private expense that embody trade secrets or are commercial or financial and confidential or privileged.

(5) "Technical data," as used in this clause, means data (other than computer software), which are of a scientific or technical nature.

(6) "Restricted computer software," as used in this clause, means computer software developed at private expense and that is a trade secret; is commercial or financial and is confidential or privileged; or is published copyrighted computer software; including minor modifications of such computer software.

(7) "Unlimited rights," as used in this clause, means the right of the U.S. Government to use, disclose, reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, in any manner and for any purpose, and to have or permit others to do so.

(8) "Limited rights," as used in this clause, means the rights of the U.S. Government and Partner in limited rights data as set forth in the Limited Rights Notice of paragraph (e)(2) of this clause.

(9) "Restricted rights," as used in this clause, means the rights of the U.S. Government and Partner in restricted computer software, as set forth in the Restricted Rights Notice of paragraph (e)(3) of this clause.

(b) Allocations of rights

(1)Except as provided in paragraph (c) below regarding copyright, Center, the U.S. Government and the Technical Monitor shall have unlimited rights in:

(i) Data first produced in the performance of this Project Agreement;

(ii) Form, fit, and function data delivered under this Project Agreement;

(iii) Data delivered under this Project Agreement (except for restricted computer software) that constitute manuals or instructional and training material for installation, operation, or routine maintenance and repair items, components, or processes delivered or furnished for use under this Project Agreement; and

(iv) All other data delivered under this Project Agreement unless provided otherwise for limited rights data or restricted computer software in accordance with paragraph (e) below.

(2) Recipient shall have the right to:

(i) Use, release to others, reproduce, distribute, or publish any data first produced or specifically used by Recipient in the performance of the Project Agreement, except to the extent provided in paragraph (d) below or otherwise expressly set forth in this Project Agreement;

(ii) Protect from unauthorized disclosure and use, those data which are limited rights data or restricted computer software to the extent provided in paragraph (e) below; and

(iii) Establish claim to copyright subsisting in data first produced in the performance of this Project Agreement to the extent provided in paragraph (c) below.

(c) Copyright

(1) In accordance with the STCU Statute, all rights worldwide to copyrights belong to Recipient. The Recipient and the Partner have agreed to protect and allocate such copyrights as specified in paragraph (c)(2) below.

(2) The Recipient has title to copyrights in the New Independent States. The Recipient hereby grants to the Technical Monitor the entire right, title and interest to copyrights in all countries other than the New Independent States. Recipient acknowledges the right of the Technical Monitor to execute all documents necessary to register copyrights in said countries. Copyrighted works jointly created by Recipient and the Technical Monitor shall be jointly owned.

(3) Recipient acknowledges that each of the Technical Monitor, the U.S. Government, Center, and each Party to this STCU Project Agreement has for itself and others acting on its behalf, a royalty-free, nonexclusive, irrevocable worldwide copyright license to reproduce, prepare derivative works, distribute copies to the public, and perform publicly and display publicly, by or on behalf of each of them, all copyrightable works produced in the performance of this Project Agreement.

(4) For all copyrighted computer software produced in the performance of this Project Agreement, the party owning the copyright shall provide the source code, an expanded abstract, and the object code and the minimum support documentation needed by a competent user to understand and use the software to DOE's Energy Science and Technology Center, P.O. Box 1020, Oak Ridge, TN 37831. The U.S. Government shall have unlimited rights in said expanded abstract.

(5) Recipient agrees to place copyright and other notices, as appropriate for the protection of copyright, in human-readable form onto all physical media, and in digitally encoded form in the header of machine readable information recorded on such media such that the notice will appear in human-readable form when the digital data are off-loaded or the data are accessed for display or printout.

(6) Recipient shall not, without prior written permission of the Partner, incorporate in data delivered under this Project Agreement any data not first produced in the performance of it and which contains a copyright notice, unless Recipient identifies such data and grants to the U.S. Government, or acquires on its behalf, a license of the same scope as set forth in paragraph (3) above, provided, however, that if such data are computer software, the U.S. Government shall acquire a copyright license as set forth in paragraph (e)(3) below if included in this Project Agreement or as otherwise may be provided in a collateral agreement incorporated in or made part of it.

(d) Release, publication, and use of data

(1) Recipient shall have the right to use, release to others, reproduce, distribute, or publish any data first produced or specifically used by Recipient in the performance of this Project Agreement, except to the extent such data may be subject to the U.S. federal export control or national security laws or regulations, or unless otherwise provided below in paragraph (d)(2) or expressly set forth in this Project Agreement.

(2) Recipient agrees that to the extent it receives or is given access to data necessary for the performance of this Project Agreement, which contain restrictive markings, Recipient shall treat the data in accordance with such markings unless otherwise specifically authorized in writing by Partner.

(e) Protection of limited rights data and restricted computer software

(1) When data are specified to be delivered under this Project Agreement and qualify as either limited rights data or restricted computer software, if Recipient desires to continue protection of such data, Recipient shall withhold such data and not furnish them to the Technical Monitor, Partner or Center under this Project Agreement except as provided for in paragraphs (2) and (3) below. As a condition to this withholding, Recipient shall identify the data being withheld and furnish form, fit, and function data in lieu thereof. Limited rights data that are formatted as a computer database for delivery to the Technical Monitor or Partner are to be treated as limited rights data and not restricted computer software.

(2) Limited Rights [This paragraph can be deleted if it is determined that there is no necessity for delivery of Limited Rights Data under this Project Agreement.]

Partner may require by written request the delivery of limited rights data that has been withheld or would otherwise be withholdable. If delivery of such data is so required, Recipient may affix the following legend to the data and the Technical Monitor and the U.S. Government will thereafter treat the data in accordance with such Notice:

LIMITED RIGHTS NOTICE

These data are submitted with limited rights under STCU Project Agreement No. _____. These data may be reproduced and used by or on behalf of the U.S. Government with the express limitation that they will not, without written permission of Recipient, be used for purposes of manufacture nor disclosed

outside the (insert name of the Technical Monitor) or the U.S. Government; except that (insert name of the Technical Monitor) or Government may disclose these data outside (insert name of the Technical Monitor) or the U.S. Government for use and evaluation by other contractors and/or entities participating in the Government's program of which this Project Agreement is a part provided that (insert name of the Technical Monitor) or the U.S. Government makes such disclosure subject to prohibition against further use and disclosure.

(END OF NOTICE)

(3) Restricted Rights [This paragraph can be deleted if it is determined that there is no necessity for the delivery of Restricted Computer Software under the Project Agreement.]

The Project Agreement may identify and specify the delivery of restricted computer software, or Partner may require by written request the delivery of restricted computer software that has been withheld or would otherwise be withholdable. If delivery of such computer software is so required, Recipient may affix the following legend to the computer software and the Technical Monitor and the U.S. Government will thereafter treat the computer software in accordance with the Notice:

RESTRICTED RIGHTS NOTICE

(1) This computer software is submitted with restricted rights under STCU Project Agreement No. _____. It may not be used, reproduced, or disclosed by the Technical Monitor or the U.S. Government except as otherwise expressly stated in this Project Agreement.

(2) This computer software may be:

(a) Used or copied for use in or with the computer or computers for which it was acquired, including use at any Government installation to which such computer or computers may be transferred;

(b) Used or copied for use in a backup computer if any computer for which it was acquired is inoperative;

(c) Reproduced for safekeeping (archives) or backup purposes;

(d) Modified, adapted, or combined with other computer software, provided that the modified, combined, or adapted portions of the derivative software incorporating restricted computer software are made subject to the same restricted rights;

(e) Disclosed to and reproduced for use by any U.S. Government contractors in accordance with subparagraphs (2)(a) through (d) of this Notice, provided the DOE facility or the U.S. Government makes such disclosure or reproduction subject to these restricted rights; and

(f) Used or copied for use in or transferred to a replacement computer.

(3) If this computer software is published copyrighted computer software, it is licensed to the U.S. Government without disclosure prohibitions, with the minimum rights set forth in paragraph (2) of this Notice.

(4) This Notice shall be marked on any reproduction of this computer software, in whole or in part.
(END OF NOTICE)

(f) Royalty Sharing

To the extent that the Technical Monitor licenses to a third party any copyrighted work produced in the performance of this Agreement which results in income therefrom, Recipient and the Technical Monitor will share the net income therefrom fifty (50%) to Recipient and fifty percent (50%) to the Technical Monitor. Net income is gross income less any expenses and costs associated with the licensing and protection of the copyrighted work including, but not limited to, the costs of obtaining and maintaining the copyright. The Technical Monitor will provide Recipient annual reports setting forth the licensing activity for said copyrighted works by the Technical Monitor during the reporting period. The Technical Monitor will provide that any agreement to license a copyrighted work produced in the performance of this Agreement will be subject to the royalty sharing arrangement between the Technical Monitor and Recipient.

(g) Employee Agreements

Recipient shall obtain agreements to effectuate the provisions of this Rights in Data clause from all persons in its employ who perform any part of the work under this Project Agreement.

IV. ADDITIONAL DATA REQUIREMENTS [This clause can be deleted if all technical data requirements are known in advance of entering into the Project Agreement and are set forth in the Work Plan.]

(a) In addition to the data (as defined in Clause III, Rights in Data-General) specified elsewhere in this Agreement to be delivered, Partner may, at any time during Agreement performance or within a period of three years after acceptance of all items to be delivered under this Project Agreement, order any data first produced or specifically used in the performance of this Project Agreement.

(b) The Rights in Data-General clause included in this Agreement is applicable to all data ordered under this Additional Data Requirements clause. Nothing contained in this clause shall require Recipient to deliver any data the withholding of which is authorized by the Rights in Data-General clause of this Project Agreement, or data which are specifically identified in this Project Agreement as not subject to this clause.

(c) When data are to be delivered under this clause, Recipient will be compensated for converting the data into the prescribed form, for reproduction, and for delivery.

(d) Partner may release Recipient from the requirements of this clause for specifically identified data items at any time during the 3-year period set forth in paragraph (a) of this clause.

V. BACKGROUND INTELLECTUAL PROPERTY [This clause can be deleted if it is determined that no Recipient Background Intellectual Property is to be used during the performance of the Project Agreement.]

"Background Intellectual Property" is intellectual property (e.g., inventions, software, copyrights, trademarks) belonging to Recipient that was in existence before this Project Agreement. A background invention is an invention or discovery of the Recipient that was conceived outside of this Project Agreement and not first actually reduced to practice (i.e., demonstrated) under this Agreement. Recipient has identified the following Background Intellectual Property that may be used in the performance of this Project Agreement: