

Biological Weapons Threats from the Former Soviet Union

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Introduction

Since September 11th, the American anthrax-laced letters and the war in Afghanistan have revived the interest of government officials, researchers and the general public to the state and security of former biological weapon (BW) facilities in the Former Soviet Union (FSU). In the popular press, reports of the general economic crisis and the political unrest that characterize FSU countries tend to emphasize the proliferation threat from these countries. Very little is said, however, about the nuances of this threat, its nature and degree of probability. Some reports tend to overestimate the number of employees at former BW facilities, thus inflating the risks of brain drain. While at the same time, other major sources of proliferation, such as the diversion of pathogens or the illicit transfer of specialized equipment are usually ignored. The present paper aims to characterize more precisely the threat stemming from former BW facilities in the FSU by determining what type of resources are available at former BW facilities and to what extent they are accessible to states of concern or terrorist groups. Although the existing open source information enables us to determine more clearly the categories of personnel, the type of equipment and material that pose the greatest proliferation threat, it does not measure properly the extent of the threat, i.e. an inventory of past and present facilities, expertise, equipment and material. Nevertheless, we can conclude that specialized knowledge, equipment and dangerous pathogens are available at former BW facilities in the FSU and can become accessible to state or non-state actors wishing to start or develop covert BW programs. This is particularly true in Central Asia, where economic and security factors, associated with the geographic characteristics of this region all converge to form a chain of proliferation: seekers of weapons of mass destruction (WMD) and their related technologies, potential suppliers and deliverers.

The first section of this paper concentrates on assessing the threat stemming from former BW facilities in the FSU and determines the categories of personnel, equipment and material that we should be concerned about as well as the nature of the threat involved. The second section of this paper identifies the economic, geographic, and security characteristics of Central Asian countries which amplify the proliferation risks from that region. The last section of the paper proposes some measures that could help reinforce existing international assistance programs at former BW facilities in the FSU, and address the specific threats posed by Central Asia.

Part I: Assessing the BW Proliferation Threat

One of the main stages in the development of a BW program consists of isolating a virulent strain of bacteria or virus that can be weaponized. This requires the expertise of specialized personnel such as microbiologists, and technical personnel with knowledge in maintaining the virulence of the pathogens through the production process, among other things. This also requires the use of specialized equipment to test the virulence of the pathogen and produce it in large quantities. This is a costly and time consuming process that very few actors can afford. However, to accelerate the process and decrease its cost, a state or non-state actor may seek to obtain pathogens whose virulence has been

tested and proven. This would change the order of priority of the resources required to develop a BW program, putting pathogens first on the list.

The Former Soviet Union gathers a large number of research institutes and production plants that were directly or indirectly involved in the Soviet BW program. Many of these facilities house collections of dangerous and virulent pathogens. These facilities also possess the other resources needed to develop and produce biological weapons – the expertise of former bioweaponeers, and the equipment to develop and produce BW on a large or smaller scale. In this context it is important to assess the risk of proliferation from these facilities and characterize the threat more precisely

A/ Characterizing the proliferation risks stemming from former BW facilities

A.1 Threats from BW Personnel

It is traditionally believed that the main proliferation threat stemming from former Soviet BW facilities lies in the great number of BW scientists who went idle after the break-up of the USSR. The proximity of countries of proliferation concern, the general chaos, and economic crisis that followed the break-up popularized arguments that these scientists may be tempted to sell their knowledge and experience to the highest bidder. Except for anecdotal stories, however, very little evidence supports this assumption. As a matter of fact, little is known about the number of former BW personnel who have left the FSU to work for other states. Part of this is due to the fact that there is no complete information source concerning the actual number of BW scientists working during the Soviet time. Depending on the source, an estimated 30,000 to 60,000 employees worked in the FSU BW sector. These figures, however, encompass the total number of employees in the BW sector, from janitors to senior weapons scientists and administrators. Because of this, these numbers do not reflect the real proliferation threat stemming from personnel possessing BW knowledge. Therefore, there is a need to more precisely characterize what personnel constitute a proliferation threat. Unfortunately, this is not an easy task due to the inherent structural organization of the former Soviet BW program. This organization is composed of several characteristics, described below, that cause difficulties in deciphering the actual number of bioweaponeers.

Multi-jurisdictional boundaries for Soviet BW research and production

Indeed, oversight of Soviet BW research and production fell under several administrations. These included Biopreparat, the Ministries of Defense, Agriculture, and Health, the KGB, and the Academies of Science and Medical Sciences (see Table 1). While some information exists about the facilities falling under Biopreparat, very little is known about the facilities under other administrations, particularly the Ministry of Defense. Further, the intentional violation of the Biological and Toxin Weapons Convention (BTWC) by the Soviet Union¹, and turf issues between the administrations resulted in the increase of secrecy within the BW program. As a result, typically each administration knew little about the existence and activities of BW facilities under the control of other administrations.

¹ The Soviet Union did not shut down its offensive BW program after signing the BTWC. . In fact, after the treaty entered into force in 1975, the Soviet Union expanded its BW program, particularly under the Biopreparat administration.

An unknown number of total Soviet BW facilities

Because of this, all former BW facilities have not yet been accounted. For instance, during conversations with FSU BW representatives, DOD officials only recently learned about a former BW research facility in Kazan, Tatarstan. Under these conditions, there is a high probability that other unknown facilities will be “discovered” in the future. Furthermore, little attention has been paid so far to the facilities that supported the BW program without being directly involved in BW production or development. These include the multitude of anti-plague stations located across the Former Soviet Union. During the Soviet time, these facilities were drawn into the BW program to identify new virulent strains of endemic pathogens and to conduct research for defensive purposes. Therefore, these facilities may have personnel with specialized knowledge involving dangerous pathogens.

No typical BW facility

Generally, when information is missing about the location of Soviet defense facilities and the number of their personnel, we can still use some tools to give a reasonably accurate approximation. Most Soviet defense facilities usually have a typical size and number of employees. For instance, it is rather easy to determine the probable number of employees in a tank production plant, because the production process requires specific equipment and a more or less determined number of employees to operate them. The location of a defense facility may also provide some clues on its size and the number of its employees. For example, the Soviet logic of development typically concentrated huge production plants east of the Urals and research centers in the European part of Russia.

Unfortunately, these tools cannot be used in the BW sector because there is no such thing as a typical BW facility. The number of employees at BW facilities and more particularly the number of BW specialists are not linked to the size of the facility (number of buildings), its main activity (production or research), nor is it related to the type of pathogens studied or developed in these facilities. Two facilities, the State Research Center for Applied Microbiology (SRCAM) in Obolensk and the State Research Center for Virology and Biotechnology (VECTOR) in Koltsovo can be used to illustrate this fact. The Obolensk and Vector BW facilities were originally built as sister research facilities; Obolensk focused its research on bacteria and Vector on viruses. In spite of their origins, the facilities came to differ in size. At their peak growth during the Soviet time, Obolensk employed 3000 personnel, while Vector grew to 5000. Interestingly, the BW production facility at Stepnogorsk, Kazakhstan, which was capable of producing 300 tons of anthrax in 300 days, employed about 4500 employees – - virtually the same number of personnel as Vector. Similarly, the Institute of Ultra Pure Biopreparations in St. Petersburg and the Institute of Biomachinery in Moscow, were also established as duplicates. Over time, however, the St. Petersburg facility came to employ 700-800 people, while the latter only 400-500.

Varying Numbers of Bioweaponeers

Another interesting peculiarity of the BW sector is that knowing the number of personnel formerly involved in BW development or production is not sufficient to adequately evaluate the proliferation threat.

It is always useful to know how many people in total were employed in the former Soviet BW program. To measure the brain drain threat, however, it is more useful to know how many specialized personnel were employed within each facility. This involves acquiring data about: (1) the number of people having a full knowledge of the R&D, production, and weaponization cycle of BW, as well as (2) those personnel with more limited knowledge concerning key BW processes. As mentioned above, it is not possible to deduce the total number of employees from the size or the main activity of these facilities and the concentration of specialized personnel varies greatly from one facility to another. For instance, in Russia the BW production plant at Berdsk was mostly a scientific and engineering site with 70% to 80% of its 150 personnel composed of scientists, with a very low percentage of support personnel. In contrast, a sister BW production plant in Omutninsk (Russia) was more diversified and larger. It had approximately 350 employees, consisting of almost an equal number of support and scientific personnel.

Blurred differentiation between production plants and research centers

In terms of scientific knowledge, it is common to assume that the concentration of bioweaponeers is higher in BW research centers than in production facilities. This assumption is flawed for three main reasons. First of all, many production facilities were originally created on a core of scientific personnel and have later preserved their research capabilities. For instance, the Stepnogorsk production site in Kazakhstan, originally had no large-scale production activity. Initially, it was a scientific development site, having several types of activities involving research, development, and scaling up of industrial BW production. In 1983, a total of 40 personnel were employed at Stepnogorsk in BW activities with only 4 or 5 being engineers and scientific technical personnel. Soon, a core of 65 military scientists from Soviet Ministry of Defense (MOD) facilities in Sverdlovsk and Kirov relocated to Stepnogorsk. By 1987, there were 300-350 employees directly involved in BW scientific or technical work. These people had capabilities ranging from the R&D, production, and weaponization processes. In contrast, the Berdsk research facility only had about 100-120 employees with specialized BW knowledge. Such breadth of knowledge at Stepnogorsk would make these bioweaponeers valuable to states or non-state actors interested in developing BW.

Secondly, production sites and research centers typically had scientific exchanges that led to a transfer of knowledge regarding BW recipes or formulations. These exchanges facilitated the propagation of knowledge and in some cases blurred the differentiation between the definition of research and production personnel.

The third reason lies in the fact that the number of specialized personnel at production sites, like Stepnogorsk, is larger due to the number of personnel employed in mobilization facilities. For example, in the Soviet time, the Stepnogorsk facility was composed of the BW production site and the civilian Plant 'Progress'. Although Plant Progress officially was a civilian pesticide production facility, it was designed to provide additional work force to the BW site in case of mobilization. Therefore, the majority of Progress employees were trained to complement or fill up all empty positions of the BW plant. They represented all the spectrum of workers, from shift leaders and engineers, to lab workers or more specialized personnel.

Who should we be concerned about?

Although it is difficult to determine the total number of personnel with BW knowledge because of all the uncertainties mentioned above, it is still possible to identify individuals who might pose a proliferation threat in known facilities.

Personnel in the former Soviet BW sector can be divided into three categories: (1) people directly involved in BW work, (2) personnel of mobilized facilities aware or unaware of their potential involvement in BW work, (3) other personnel not directly involved in BW work.

Soviet Administrations involved in BW activities

The first category includes two groups of people: (a) people with full knowledge of the entire BW R&D, production, and weaponization process, and (b) personnel specialized in individual steps of the BW process. In these two groups, personnel include directors of facilities and their deputies, department chiefs, laboratory heads, senior engineers, senior scientists, and some laboratory employees.

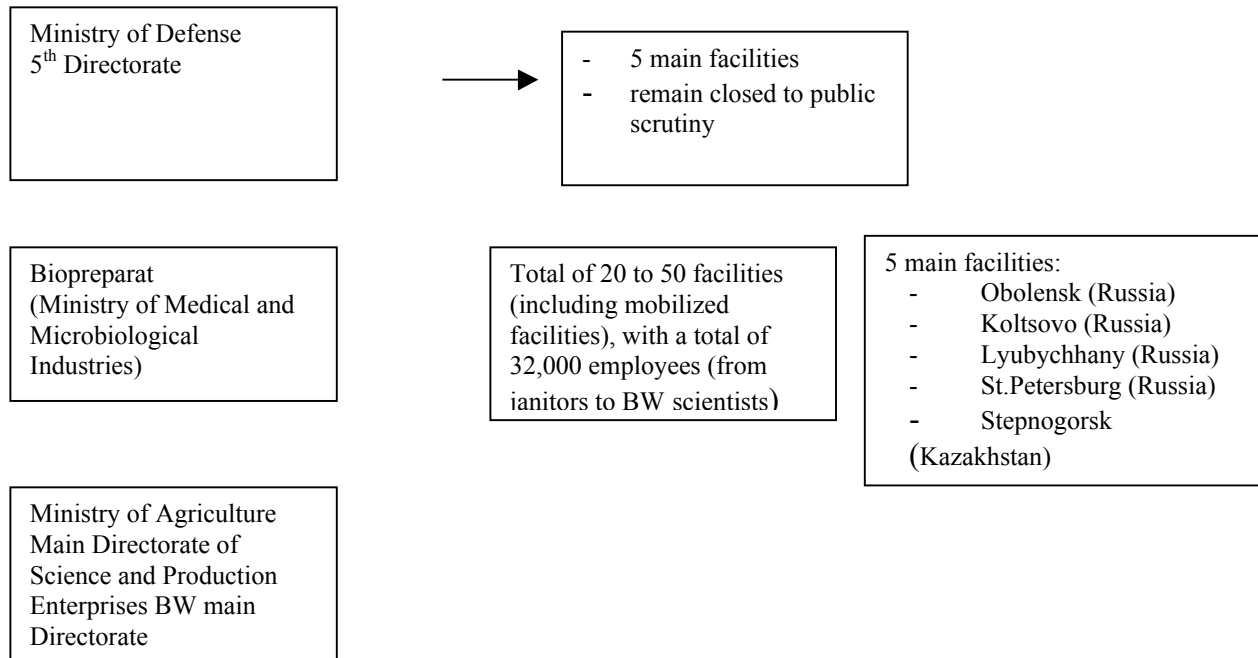
Next, the second category includes personnel that may not have direct experience in the development or production of BW, but who have been trained to be quickly operational. For instance, laboratory workers working on a non-BW strain of *Bacillus* bacteria can utilize their skills to then start working on *Bacillus anthracis* (causative agent of anthrax). Typically, *Bacillus* bacteria are similar in terms of cultivation, although specific growth parameters would need to be determined for each type of *Bacillus* bacteria. Other differences would involve the knowledge of using strict biosafety requirements in working with the *B. anthracis* strains, particularly in large quantities or in cases where aerosolization of the bacteria could occur.

The third category of personnel includes all other support staff employed by BW sites or mobilized sites who do not have any direct connection with BW activities or any knowledge in this field (i.e., janitors, social infrastructure personnel). These personnel have no proliferation risk since they have never worked or been involved in any aspect of BW work.

We should be primarily concerned by the first category of people. Those who have a wide knowledge of the R&D and/or production process can indeed be used as master trainers in covert BW programs. As mentioned earlier, new recruits in the Stepnogorsk production site were trained by a core of 65 scientific specialists who came from Soviet MOD facilities. According to Ken Alibek, former director of this facility, only a short teaching period – two to three months – was required to train people with basic microbiology techniques to work with BW agents. These employees could then become fully operational in a pre-war period.

Personnel specialized in certain stages of the development/production of BW or in a specific pathogen are also of concern. These individuals would have experience in key areas such as maintaining the virulence of pathogens through production, storage, and dissemination. State or non state actors seeking to develop a BW program would probably be interested in attracting people with specific knowledge from a variety of FSU facilities in order to maintain the secrecy of their illicit BW activities.

A.2. Measuring the threat from BW personnel



Now that we have characterized the threat from BW personnel, we still need to determine the extent of this threat. There are, however, many obstacles to this. As we mentioned earlier, the concentration of specialized personnel in each BW facility depends on how the facility developed over time, not on its size or main activity. There are also many uncertainties on the fate of the personnel who left these facilities after the break-up of the USSR. For example, in Stepnogorsk, 70% to 90% of the specialized personnel left the facility after the break-up of the USSR. Although their departure took place in several waves, it is believed that the military personnel returned to Russia. Some resumed work in Russian MOD facilities. Some people also resigned from their positions and became civilians. Others went to Russian Biopreparat facilities or to universities or institutes where they received their degrees.

We may believe that former personnel who quit the sector after the break-up of the USSR do not pose a continuing “brain drain” threat. Some would argue that these scientists may have lost part of their specialized knowledge – and more particularly tacit knowledge – during these years. In the BW field, however, it is more relevant to know how many years these people worked on BW than how many years they did not work. For example, a scientist with 20 years of experience in the field may recall techniques, formulas, or recipes used during his service time more easily after five years of non-service, than a scientist with only 5 years of experience in the BW field. Yet, there are no available data regarding the years of service of BW scientists. This information can be obtained for those personnel who still remain at specific facilities. But little is known about the personnel who quit, because facilities themselves do not collect this type of data regarding their personnel. Other known facilities, such as those under the control of the Russian Ministry of Defense, remain closed to international visitation. Under such conditions, it is very difficult to accurately estimate and characterize the technical personnel that pose a real proliferation threat.

A.2. Threats Stemming from Specialized Equipment

The threat stemming from specialized equipment available at former BW facilities is generally overlooked or poorly characterized. Although biotechnology production equipment is dual use and commercially available, some of them, like high containment biosafety systems, drying and milling machinery, aerosol test chambers, and large fermentors are rather unique to BW production. The export of such equipment is controlled under the Australia Group list². This equipment can be used for legitimate purposes and their export/import can be justified. However, a state or non-state actor in the process of developing a covert BW program will probably try to obtain such equipment through covert or illicit means to protect the secrecy of its BW activities. Considering that export control systems and mechanisms in the FSU are still at the embryonic stage, the possibility of an illicit export of such equipment should not be overlooked.

Industrial production equipment, with a production capability of more than a 1000 liters, is not the only type of equipment we should be concerned about. Many research facilities in Russia and other New Independent States (NIS) had in the Soviet time small-scale BW production capabilities (less than a 1000 L) and they have retained this equipment to this day. This equipment is more accessible than large-scale industrial production equipment and poses a real – often overlooked – proliferation threat.

The reality of the threat stemming from specialized production equipment is a condition of the amount of pathogens a perpetrator plans to produce to serve a particular purpose. If the purpose is to cause mass casualties, a large amount of biological agent will be needed. In that case, industrial-size production equipment will be required.

On the other hand, if the interest is to grow enough biological agent to release in a specific area and cause a smaller number of casualties, or create panic, large industrial equipment is not needed. Pathogens, such as bacteria, can be grown in small fermentors, with volumes of 100L or less. In addition, a small-scale production laboratory would typically involve biosafety level 2 protection (fume hood, surgical masks), a centrifuge separator, a lyophilizer (freeze drying), cross-flow filtration equipment³, and an autoclave (sterilization). A crude aerosol chamber could also be set-up in order to test the effectiveness of the agent on animals. Freezers that are cooled to liquid nitrogen temperatures (-70C), as well as standard refrigerators would also be needed to store biological material.

The threat is also influenced by the availability of specialized equipment at former BW facilities and their accessibility to state or non-state actors. Today, there are 7 known large production facilities (Sergiev Posad*, Strizhi*, Kirov*, Omutninsk*, Kurgan*, Berdsk*, Stepnogorsk⁺) and 2 smaller production facilities (Pokrov*, Biocombinat⁺). Among the large production sites mentioned above, only the Stepnogorsk facility has been dismantled in the framework of the U.S. Cooperative Threat Reduction (CTR) program. This project at Stepnogorsk was completed in 2000

² However, Russia is not a formal party to the Australia Group, although it abides by it in theory.

³ Specialized equipment that separates biological material.

* Located in Russia.

⁺ Located in Kazakhstan.

and consisted of the dismantlement of equipment unique to pathogenic microorganisms. This included special biocontainment systems (ventilation, filtration, submarine doors), air-handling and waste treatment systems, fermentors (ten 20,000 liter fermentors, twenty 2,000 liter fermentors), and autoclaves. The 300m³ aerosol testing chamber that was used to test extremely dangerous viral and bacteriological pathogens in the Soviet time, had been destroyed at the end of the Soviet era. Therefore, with this dismantlement, the threat stemming from the equipment of the Stepnogorsk facility has been eliminated.

However, the fate of the equipment in the other large and smaller production facilities located in Russia is still unclear as no similar dismantlement program has started in Russia. Some of these facilities have been visited by U.S. specialists, but access to the sites varies from one facility to another. In many cases, U.S. specialists are still trying to inventory the available equipment. MOD facilities, on the other hand, remain closed to international scrutiny. There may also be other production sites, having sensitive production equipment, whose existence or involvement in the Soviet BW program is still unknown.

Further, former BW research institutes also retain some small-scale production capabilities that can be used for BW development and production. For example, this equipment is available not only at the Vector facility in Russia, but also at the Scientific Research Agricultural Institute and the Anti-plague Institute both in Kazakhstan.

The restructuring of production facilities that took place after the break-up of the USSR also led to the dispersion of some equipment that can be used for BW production. For instance, the Institute for Pharmaceutical Biotechnology, a civilian spin-off that was created on the basis of the former BW production plant of Stepnogorsk is now using some equipment, a lyophilizer and fermentors, that were brought from the former military laboratories.

What should we be concerned about?

Unregulated export of equipment that can be used for BW development and production is a major concern.

Small scale BW production equipment that many former BW research institutes in Russia and other FSU republics still house can be easily transported and concealed. This is especially true given that such equipment is not necessarily specific to BW production and is therefore not covered by international assistance programs or controlled by international regimes.

We may believe that since large-scale production equipment, such as specialized fermentors and reactors, are subject to trade restrictions, their unregulated export is less probable. Yet, export control systems in former Soviet republics are still under development and in many cases they are either non-existent or not working. Some newly independent states, like Ukraine do not have export control lists and some others are still in the process of introducing CW and BW related equipment and technologies in their dual-use lists. Further, customs officers at the borders are little informed about the equipment that can be used for BW production purposes. As most of this equipment is dual use and can be used for legitimate pharmaceutical or other purposes, it is very doubtful that customs officer will detect any covert or illicit exports. Even in Russia, which is more advanced in the field of export controls development, export controls are poorly implemented. This is due to various factors including, the numerous changes in

the regulations, the lack of coordination among the administrations involved in the process and the lack of training of customs officers and equipment at the borders. Yet, most of the known large and smaller BW production sites are located in Russia.

The financial and scientific means required to acquire, operate and maintain an industrial BW production capacity are very high and it is probable that only states could afford such programs. Non-state actors, however, would probably be more attracted to smaller scale equipment. The former Soviet Union is surrounded by both types of threats: states as well as terrorist groups interested in acquiring the capability to start or expand their BW programs. Part II of this paper will develop this issue in more detail.

Without a clear inventory of the specialized equipment available at former BW production sites it is very difficult to (1) evaluate the extent of the threat stemming from specialized BW production equipment, and (2) determine how accessible this equipment is to state or non state actors.

B/ Proliferation threat stemming from Strain collections

One of the proliferation threats that is generally overlooked or ignored is the existence of exotic strain collections residing in FSU BW facilities. These collections include unique and virulent anti- animal, plant and human pathogens. Yet many of them are insufficiently secured and their accounting system is seldom reliable. This can make them accessible to inside or outside diversion. The insider threat, however, is more of a concern as employees have access and the ability to secretly divert pathogens.

Existence of various strain collections with unique and virulent pathogens

The identification of a weapon-usable strain requires years of research and testing. For instance, 650 different strains of the *Clostridium botulium* bacteria, and over 20 strains of *Bacillus anthracis* were tested in the former U.S. BW program before the ideal weapon-usable strains were identified. Pathogens could also be isolated from nature, however, these may not be virulent pathogens and therefore unusable as weapons. In these conditions perhaps the quickest and cheapest way to obtain virulent agents is to obtain them from former Soviet bioweapons laboratories.

The former Soviet BW research institutes have extensive collections of viral and bacterial anti-crop, anti-animal and highly dangerous human disease strains. Some collections contain unique pathogens, with no equivalent in other countries. Other strains are highly virulent strains, with some being genetically engineered to be environmentally stable and resistant to medical treatments. For instance, the Russian MOD collection possesses more than 100 different types of strains of *B. Anthracis*. The main pathogen repository at Vector – Russia – gathers over 10,000 viral specimens, with 109 different samples of the smallpox virus. The Scientific Research Agricultural Institute, in Otar, Kazakhstan, has a unique collection of 190 strains of a variety of dangerous animal diseases like FMD, African Swine Fever, Newcastle disease, sheeppox, and rinderpest, which have been eradicated in the United States. Some of these pathogens are readily transmissible by air, with fatal outcomes nearing 100%. The All-Russian Research Institute of Phytopathology, Russia, contains 1,650 strains of plant pathogens.

No reliable accounting system (past and present)

Generally, FSU strains are individually labeled with information documenting the type of strain, disease name, and volume of material in the ampule. Inventory of these ampules is traditionally kept in special logs that must be numbered, sewn and secured with a seal. Data on the movement, consumption and supply of each ampule are also recorded in the logs. These logs however, are usually simple notebooks, where the inventory of pathogens is written with a pencil. Simple wax seals are typically used to seal the doors to the refrigerators and strain museums. This accounting system is still in place in most facilities, although there are some attempts to modernize the inventory and security systems. For instance, the U.S. CTR program is now upgrading the accounting system of the agricultural research facility in Otar, Kazakhstan. This includes the construction of a new building to house the Institute's strain collections, the introduction of a computerized accounting system with barcodes, as well as secured refrigerators. These upgrades, however, started only in spring 2000 and have yet to be completed.

Reliable accounting is also challenged by the fact that some collections are not centralized within facilities. In general, institutes gather different types of bacteria or viruses and store them in different buildings or laboratories on-site. In some cases, however, there are no uniform storage facilities for pathogens. For example, within the anti-plague network, both field stations and institutes can possess reference and field specimens. In addition, some laboratories maintain secondary repositories at off-site locations to protect collections in case of disaster. Although this is standard procedure in western countries, accounting and security of off-site pathogens collections is made more difficult in the FSU where security and accounting measures are already primitive⁴.

Little biosafety and physical security

One of the characteristics of many former Soviet BW research institutes is their ability to work on dangerous pathogens without high containment bio-safety equipment. For instance, scientists in the Anti-plague institute of Almaty, Kazakhstan, worked and still work on plague strains in a small room with no fume hood or ventilation system. In contrast, such work in the United States would require a level 2 biosafety containment.⁵

Physical security at these institutes is also minimal and generally orientated to protect the facility against outsiders. The Vector facility for instance is guarded by MVD troops and locally hired and trained security forces. However, the facility's perimeter is deteriorated and physical security equipment is limited. Until recently, the Anti-plague Institute of Almaty was easily accessible by road, with no fences protecting the facility. Guards were unarmed and privately hired by the facility. The strain collections at the Otar facility and the Anti-plague Institute of Almaty, Kazakhstan were located in unprotected rooms with simple wooden doors, locked and bearing a wax seal. At both facilities, several intruders have been reported. Most of the time, these incidents involved

⁴ It is worth noting that accounting and security of biological facilities is a relatively recent concept; For instance, in the U.S., many research facilities are not adequately safeguarded and U.S. workers could divert pathogens too if they were bribed. Control of pathogens is an international problem that has received little attention.

⁵ Note however, that very precise handling procedures for work with dangerous pathogens had been developed in the Soviet time. Therefore, Soviet scientists are extremely skilled in handling pathogens under such low containment conditions.

people who were only interested in stealing scrap metal to be sold on the market, or drunken soldiers. These intrusions, however, show that the existing security at these facilities should be reinforced. As mentioned earlier, the Otar facility and the Anti-plague Institute in Almaty are now undergoing biosafety and security upgrades under the U.S. CTR program. This assistance involves the reinforcement of perimeters (fences, check-points and guards), the installation of physical protection equipment (cameras, sensors), and building improvements for the strain collections. These types of upgrades, however, are less common in Russia.

What should we care about?

Risks of diversion

In a context where accounting of dangerous pathogen is deficient and where security and safety are not assured, the diversion of virulent pathogens involving outsiders or insiders is possible. The insider threat is even more worrisome given the desperate economic situation of former bioweaponeers and BW institutes.

In 1992, after the decision was made by President Yeltsin to halt all BW offensive research activities, state funding to former BW facilities has sharply decreased. At some facilities in Russia the share of state funding in their total budgets is less than 3%.

Similar situations are encountered in the other republics of the former Soviet Union. This situation has led to a number of financial difficulties that have an impact on the security and safety of pathogens and personnel. For instance, even if facilities upgrade their security systems, they may not be able to maintain them properly.

Economic difficulties also translate into long wage arrears. For instance, at the Otar facility, as of April 2001, the personnel had not been paid for six months. Salaries are also typically very low. At the Stepnogorsk facility, the average salary of scientific personnel is about \$70/month. Even former BW scientists involved in international assistance programs receive a very low salary increase thanks to these programs, sometimes receiving no increase at all. This generates a sense of frustration and desperation, which could increase the threat of pathogen diversion.

Nature of storage and pathogen diversion

The nature of storing pathogens can facilitate the diversion and transport of pathogens. For instance freeze-dried biological agents have long shelf lives even at room temperature. This makes them easy to transport and retain viability. For instance, of the small pox cultures stored at the Vector facility, 90 strains are preserved as frozen material, 24 are lyophilized (freeze-dried). At the Anti-plague Institute in Almaty, 900 strains of plague are stored in dried form. An ampule of agent typically contains less than 1 gram of biological material. For certain animal diseases, one gram of material can yield millions of lethal doses.

Insider threat

Under poor economic conditions, the insider threat is worrisome. Insiders can more easily divert dangerous pathogens for several reasons. First, they are usually vaccinated against a particular agent or all those used in the facility. For instance, at the Almaty Anti-Plague Institute, Kazakhstan, all personnel from *guards* to the director of the facility are immunized against agents in the collection. Further, many former BW

facilities have lost a lot of their former personnel and have replaced them by new young recruits. These recruits have access to pathogens, have limited loyalty towards their facilities, and are often unaware of the legal consequences of their actions. Because of this, they could be tempted by monetary inducements from outsiders. Some cases of diversion by insiders, researchers, have already been reported in Kazakhstan. However, these people have not been arrested or prosecuted, but simply fired. One of the reasons for the lack of prosecution was the preservation of facilities' reputations and the desire to avoid negative publicity. This cultural factor is another reason why more attention should be paid to the insider threat. Under these conditions, past diversion attempts (successful or unsuccessful) or future attempts may go unnoticed even at facilities undergoing security upgrades in the framework of international assistance programs.

Another potential source of proliferation lies in the scientific exchanges that facilities currently have with foreign research institutes. For example, the Almaty Anti-plague Institute organizes training programs for biologists that include specialists from countries such as Vietnam, China and other countries of the FSU.

Such contacts could lead to technology transfers and put scientists in contact with potential buyers.

Although the insider threat concerns all employees of BW facilities from guards to scientists, personnel having direct access to pathogens through their daily work have more possibilities to divert pathogens without detection.

One opportunity for diversion can occur when strains are transferred from repositories to the research laboratories. It is indeed very difficult to track the movement of these strains during these transfers. Existing regulations in Russia require that all research work involving dangerous pathogens must be conducted in teams with a minimum of two persons. Work in the evening, night, during holidays or days off can be performed only with a written permission of the institute director. Transfer of pathogen cultures from one section to another is allowed only by persons cleared to work with dangerous pathogens and with an escort. However, sometimes these rules can be waived for senior researchers who have earned the right to work independently. Furthermore, the two-person rule did not exist in Kazakh facilities and was only recently imposed by international assistance programs. In theory, all movement, use and destruction of pathogens must be recorded in special logs. In practice, however, these regulations are not always respected. It is also possible to record pathogens as destroyed while they have actually been diverted.

Another diversion opportunity is during laboratory work. Laboratory work with pathogen can generate larger quantities of biological material than originally used. In this context, it is very difficult to account for the additional quantities of biological agents that have been generated in the laboratory, and whether these could be diverted.

Diversion can also occur when pathogen samples are transferred from a branch to the main institute. The strains collected from nature by the anti-plague stations are usually transferred to the main anti-plague institutes. Considering the wide distances existing between the out-stations and the main institutes, the risk of diversion during transport should not be ruled out.

A counter argument to the insider threat lies in the fact that employees are subject to a background check prior to employment. During the Soviet period, employees of sensitive facilities received security checks involving a span of three generations. Yet,

this procedure has changed after the break-up of the USSR. Now, new personnel are usually hired through open employment and security checks are limited. This is particularly true in those facilities, which have lost a lot of specialists after the break-up of the USSR, and have had to replace them by local young scientists.

B.3/ Extent of the threat from strain collections.

Under such conditions, dangerous pathogens at former FSU BW facilities are not only available but also accessible due to the lack of efficient accounting methods and security systems. However, measuring the extent of the threat from dangerous pathogens collections is also a non-trivial task for several reasons.

First, just like the number of former BW facilities is still unknown, the number of strain collections is also unknown. As mentioned earlier, the U.S. Department of Defense has recently found out about the existence of a research facility in Kazan that was involved in the former Soviet BW program. This facility houses an impressive collection of animal and plant strains that is comparable to that of the Otar facility in Kazakhstan.

We may argue that knowing the number of strain collections is not relevant to measure the extent of the threat, since one small ampule taken from a known collection can by itself cause great damages. In order to accurately determine the threat of diversion and develop adequate measures to prevent it, however, it is important to locate these collections and determine the type and virulence of the strains they possess.

Second, there is a great uncertainty concerning past activities of some facilities. Mobilization facilities at Berdsk, Kurgan, Omutninsk and Penza have worked with a number of different pathogenic organisms. At the present time, it is still unclear whether these facilities retain stocks of these agents. Further, we have little understanding as to the strain collections at Russian MOD facilities. Anti-plague stations may also have limited strain collections. Today, these stations continue to serve as regional collection sites for disease surveillance. It is estimated that about 40 anti-plague stations have small working collections of pathogens isolated from different natural sources.

Further, the restructuring of BW facilities after the break-up of the USSR has led to the dispersion of strains collections. For instance, after Russia's renouncement of an offensive BW program, many institutes have been transformed into joint stock companies. This has led to the creation of spin-off companies based on former BW institutes. Some of these companies have retained or acquired their own stocks of pathogenic organisms for commercial sale. For example, Ken Alibek states that employees of a former BW facility started their own biotech company, advertising the sale of genetically engineered strains of tularemia bacteria⁶.

C/ Proliferation threat stemming from Biological Weapons stocks

There is very little information on the potential existence of BW stocks in the FSU. According to the Russian government, stocks of weaponized agents were destroyed in the Soviet time. There were two known BW storage sites in Russia: Reutov near Moscow, where BW warheads, bombs and bomblets were stored, and Zima in the Irkutsk region, which housed anthrax weapons. It is unclear whether weaponized agents were

⁶ Ken Alibek, *BioHazard*, Random House, New York, 1998, p.272.

stored in other republics. According to a former official of a Kazakh BW facility, Soviet BW previously stored in Kazakhstan had been sent back to Russia. However, no official confirmation or proof of their storage in Kazakhstan was found after the break-up of the USSR. Similarly, details on how, where and when Soviet BW stocks were destroyed haven't been provided.

To this date, it seems that Vozrozhdeniye Island (commonly named Voz. Island) the former Soviet BW test site in the Aral Sea, is the only known depository of weapon grade agents. During the Soviet period, Voz. Island served as a proving grounds for several different biological weapons agents including, Anthrax 836, the Soviet's most deadly weapons grade form of anthrax, developed at the Sverdlovsk facility, Russia. In 1988, a decision was made by the Soviet government to destroy the stocks of anthrax on the island. The anthrax spores were mixed with decontamination agent and placed in an undetermined number of 250-liter stain-less steel tanks. These tanks were used to transport and bury the material in 11 pits covering an area as large as half a football field, on the Uzbek side of the island. After Ken Alibek (a Soviet defector) revealed that weaponized anthrax had been buried on the island, a U.S. Department of Defense [?] traveled to the island and took samples. These samples revealed the presence of viable spores of weaponized anthrax⁷.

The risk of proliferation from the island is extremely high. Indeed, The Aral Sea has been shrinking dramatically since the 1960s, when the Soviet government decided to divert the waters of the two main rivers flowing into the Sea to irrigate cotton fields in Uzbekistan. As a result, the sea has receded 70 miles and its surface area has decreased by 40%. There is now a land bridge from the mainland to the island on the Uzbek side, and individuals regularly go on the island to gather scrap metals.

Although specialists tend to believe that the development of biological weapons on the basis of agents collected from the island would pose a certain amount of technical problems, the use of these spores for terrorist purposes should not be ruled out.

After September 11, the U.S. and Uzbek governments signed an agreement, providing for the decontamination of the 11 pits. Decontamination work should start in the spring of 2002 and be completed in few months. Further, Uzbek troops are now restricting access to the island. However, considering the large area to be protected, it is doubtful that complete security around the island can be assured. In addition, access to the island is still possible on the Kazakh side. In this context, proliferation threats from the pits will be eliminated only after full decontamination of the island.

Part II: Proliferation Risks from Central Asia

Considering that Russia gathers the greatest number of former BW research institutes, production facilities and strain collections, we may believe that the extent of the proliferation threat stemming from personnel, specialized equipment and strain collections is probably greater in Russia than in the other republics of the FSU. Central Asia on the other hand, gathers fewer facilities – six known facilities and their affiliates in Kazakhstan and Uzbekistan – suggesting that the threat from these countries is lower. However, the war in Afghanistan commands us to pay more attention to the facilities

⁷ Because the spores tended to clump together, some were protected from the bleach and thus remained viable in the soil.

located in these countries. Further, without downplaying the importance of the threat from Russian facilities, there are reasons to believe that the probability of the proliferation threat from Central Asian facilities is much higher. Indeed, the geographic, economic, legal, and security characteristics of the Central Asian countries and of their former BW facilities increase the accessibility level of sensitive knowledge, equipment and pathogens to state and non-state actors located in the vicinity.

Geographic Aspect

Unprotected open borders

Central Asia has a unique geographic situation. It is surrounded by two nuclear states – Russia and China – and countries of proliferation concern such as Iraq, Iran, Afghanistan, India, and Pakistan, who are developing or trying to develop offensive nuclear, biological or/and chemical programs. Central Asian countries share long frontiers with these countries, which in some areas go through mountains and long stretches of steppe and desert areas, which remain unprotected.

Even in the nuclear field, which so far has benefited from the lion's share of international assistance in the NIS, most customs points in Central Asia are not equipped with radiation detection devices and training of customs officials to detect nuclear/radioactive material is still weak⁸. The detection of illicit transfers of BW material and technology is difficult since there is no detection equipment to uncover trafficking of BW equipment/pathogens to date. As BW materials give off no unique signatures, the only means for customs officials to detect BW trafficking is to resort to their instinct, based on proper training. Thus far, there have been no training programs designed to help customs officials at the border detect and identify the trafficking of dangerous pathogens or BW-related equipment. Customs' work at the borders is generally limited to the fiscal aspect of exports (levy taxes) and checking paper work, which is less than sufficient to prevent proliferation.

Nonexistent or inefficient export control systems

Central Asian countries are at various stages of the development of their export control systems, with Kazakhstan being among the most advanced and Tajikistan, Kyrgyzstan, and Turkmenistan being at the other end of the spectrum. Most of them have developed some sort of export control legislation (laws, government resolutions, presidential decrees) but their export control mechanisms are usually inefficient or simply non-existent. For instance, in Kyrgyzstan licenses have so far been granted post-facto, when shipments were stopped at the border. Similarly, prior to November 2000 when the Kazakh government decided to adopt the European control list, Kazakhstan, which is yet the most advanced in this field, did not yet have a list of controlled technologies and material⁹. Control was performed using the CIS TNVED codes, which indicate the commercial value of goods, not their sensitivity.

⁸ For instance, in Kazakhstan major road traffic points – 2 with Russia and 6 with China – are not equipped with radiation detection devices. Similarly, the Karakorum highway, which crosses mountain passes and links Kyrgystan, Tajikistan, China and Pakistan, is not protected with radiation detectors, and the mountain passes are not monitored

⁹ Actually, Kazakhstan had a general list which was very limited in scope. CNS Export Control working group, Almaty, Kazakhstan, June 11-12, 2001.

The inadequacy of export control systems is aggravated by the inability of Central Asian countries to build and reinforce their institutions. For instance, turnover in administrations involved in export controls is very high and very often trained and competent personnel are replaced unexpectedly with no valid reasons. For instance, in March 2001, the export control department in Kazakhstan was reorganized, renamed and its personnel replaced. This occurred at a time when the department was organizing its transition to European export control lists. Due to the time and personnel lost in the reorganization, it is likely that CW and BW related material and technologies have not yet been included in the control lists.

Drug/WMD trafficking routes, terrorist activities and location of sensitive facilities

Most of Central Asian former BW facilities are located close to borders and in the vicinity of major hotbeds of terrorism¹⁰, as well as drug or arms trafficking routes (see map 1). For instance in Kazakhstan, most of the regional and field anti-plague stations depending on the Anti-Plague Institute of Almaty are located along the southern border of Kazakhstan which is the usual route taken by drug and WMD-related traffickers. The Scientific Research Agricultural Institute in Otar is also located in the vicinity of the terrorist activity line, which follows the south-eastern border of the country, and close to the drug-trafficking route which goes from Afghanistan to Russia through Kyrgyzstan (Bishkek) and Kazakhstan. The region around Tashkent in Uzbekistan, where two former BW research institutes are located, is also a major center for drug and WMD-related trafficking as well as terrorist activities.

Terrorist activities put sensitive facilities at risk as they can be caught in the middle of clashes between terrorist groups and the police. They can also be exposed to accidental or voluntary attacks. The proximity of former BW facilities to drug trafficking routes also raises the specter of increased proliferation. Indeed, according to official reports from Kazakhstan and Tajikistan, criminal groups have already seized the traffic of radioactive material. Some incidents show that criminal groups use a large number of middlemen, and there are already some cases when “innocent” and uninformed persons were used by traffickers to take radioactive material through the borders. To date, no trafficking incident involving BW-related material has been reported. However, considering the nature of this type of material and the lack of training of customs officials at the border, there is no guaranty that BW-related trafficking has not taken place already.

Legal Aspect

In addition to the geographic factors, legal issues help further lower the threshold of proliferation in the region. Indeed, the legal status of pathogens – property rights – as well as the in-country exchange and export mechanisms do not provide sufficient barriers

¹⁰ September 11 and the war in Afghanistan have shed some light on terrorists groups of Central Asia, that were unknown to the general public. However, these groups have been active for several years now. For instance, the Taliban from Afghanistan – Islamic fundamentalist groups – periodically penetrate in Uzbekistan and Tajikistan, through Kyrgyzstan. In April 2000, they even reached the limits of the Tashkent Oblast in Uzbekistan, getting closer to the capital Tashkent. The extremist group “Islamic Movement of Uzbekistan” also makes regular incursions in Kyrgyzstan through Tajikistan. In Kazakhstan, in September 2000 a group of Uigur terrorists – Chinese separatists – were chased and eventually killed by the police and internal troops downtown Almaty, the former capital of Kazakhstan..

against proliferation. For instance, in Kazakhstan, the export of dangerous pathogens is subject to authorization by the Ministry of Health. However, pathogens are officially the property of the institutes where they are stored, and the owner can dispose of them freely (buy or sell). Further, in-country exchange of pathogens is authorized by the head of the institute without prior authorization from the ministry of health. This leaves the door open to proliferation, as pathogens sold or exchanged in country, can easily be exported by the buyer or sold again without attracting the attention of security services.

Economic Aspect

As mentioned earlier, most FSU BW facilities suffer tremendous economic hardships, leading to very low salaries and long delays in their payment. In Central Asia however, the consequences of the poor financial situation at sensitive facilities has to be taken very seriously as the standard of living in these countries is much lower than in Russia. The consequences of the economic crisis also expand to the second line of defense (i.e., customs officials), thus making the prevention of illicit trafficking more difficult.

Extensive corruption of civil servants

The economic crisis and the preservations of some Soviet habits and behaviors, have lead to widespread corruption in state institutions. More particularly, some law enforcement representatives – like Customs officials – are well known for their corruption. Traffickers have developed extensive networks and mechanisms to circumvent proper inspection of their packages.

Poor financial situation of law enforcement services

In most cases, law enforcement services operate with limited budgets. This has a direct negative impact on their training and equipment but also on their ability to investigate incidents. According to Kazakh Committee for National Security (KNB) officials, incident investigations in Kazakhstan are usually very limited due to the lack of funds. This in turn does not allow the KNB to trace trafficking routes, determine traffickers' motivations, measure the extent of the problem and finally design optimal counter-proliferation measures¹¹.

In a nutshell, Central Asia constitutes a meeting point for the three types of actors involved in proliferation of WMD related technologies: (1) WMD related technologies seekers – rogue states and terrorist groups interested in acquiring material that can accelerate their military programs and generate panic in the public respectively; (2) potential suppliers – impoverished biological facilities or their employees. (3) and potential deliverers – organized crime, terrorist groups and innocent people motivated by monetary compensations.

The weakness of state institutions, the wide spread corruption, the economic crisis, the incomplete legal basis, the incomplete or nonexistent export control systems, and the unprotected open borders increase access to dangerous pathogens and personnel of former BW facilities, thus increasing the risks and the probability of proliferation.

¹¹ Workshop on Illicit trafficking in Kazakhstan, Committee of Atomic Energy, Almaty, Kazakhstan, May 21-25, 2001.

Part III: Recommendations for Additional International Assistance to Deal with Threats Involving Personnel, Equipment, and Strains

Security as an integrated system

One of the main conclusions that we can draw from the developments above is that a nonproliferation policy that would efficiently increase the security of facilities, their personnel, strain collections and equipment has to operate simultaneously on the technical, financial and educational levels, and integrate these measures into a system adapted to each facility.

Most U.S. assistance programs to former BW facilities in the FSU have so far concentrated on the technical level by upgrading the biosafety and security systems at facilities. This is a number one priority, especially in Central Asia. This approach has immediate results since it provides the required equipment to help address the outsider and insider threat. In some cases computerized accounting systems have also been introduced. However, much still needs to be done to promote the implementation of rigorous accounting protocols of material used, such as those generated during work or consumed. This involves educating personnel about nonproliferation. Without this element, standard technical solutions provide only half of the solution to address the complete proliferation threat.

There is a need for the creation of a nonproliferation mentality within the BW sector. This aspect is often left out by international assistance programs because its results show only in the longer term, while assistance programs tend to focus on the short term. Yet, security can be highly increased by introducing new behaviors and routines. This can be achieved by the development of educational programs detailing topics such as the purpose of international regimes or the sanctions attached to illicit trafficking, to name a few. This education will provide the “cement” to reinforce the technical measures and short-term assistance programs. A nonproliferation component can also be included in the training programs provided by some former BW facilities to regional or foreign specialists. This will help reach a greater number of specialists, whether they be former bioweaponeers or younger new recruits.

It is also extremely important to ensure the financial stability of facilities and their employees. International assistance programs sponsored by the ISTC, or the U.S. Department of Energy (Initiative for Proliferation Prevention – IPP) for instance, concentrate on key personnel with BW knowledge. They support peaceful research programs to ensure a regular salary to BW scientists. This is also a very high priority, which directly addresses brain drain concerns and to a certain extent the insider threat as well. However, these programs so far have employed a very limited number of former BW scientists. Their scope should be expanded to engage a greater number of former BW facilities and more particularly those falling under national ministries of agriculture¹². This may also help identify new facilities formerly involved in the Soviet BW program as well as other significant pathogen collections.

One of the weaknesses of these programs is that in their attempts to support scientists directly they overlook the financial situation of the facilities. Yet, as

¹² In the Soviet time, 1/3 of the manpower affiliated with the Biopreparat complex worked on biological agents targeted at agriculture

international assistance funds are paid by installment, researchers have to live on the salaries paid by their institutes. Unfortunately, these salaries are often delayed. Under these conditions the efficiency of these programs in preventing brain drain is greatly diminished. Further, considering the difficult economic situation of these facilities, any employee in these institutes can be tempted to divert pathogens, especially when all employees are vaccinated against the pathogens housed in their collections. Therefore it is extremely important to consolidate the financial situation of these facilities by supporting long-term redirection activities, like vaccine production for infectious diseases, or the production of generic drugs, which can provide a regular income to the facilities.

It is also important to remember that each facility faces particular challenges. Therefore a threat analysis describing the assets that need to be protected and the specific threats facing each facility needs to be conducted for each facility. This will help fine tune the security system at each facility and determine the order of priority of the educational, financial, and technical measures mentioned above to reach an optimum security system.

Creation of a guard force specifically trained to protect BW facilities

The risks of diversion of strains by insiders can also be prevented by the creation of a special force trained to protect BW facilities. So far, FSU BW facilities have been guarded either by guards privately hired by facilities or by troops of the ministries of interior. The first are subject to the same hardships as any employee of BW facilities and the later are composed of conscripts who are replaced on a regular basis.

There is a need for a more specialized and long-term guard force that would be independent from facilities. Their training would help them identify such elements as pathogens containers, weak points of potential diversion, etc. Their task would be primarily to address the insider threat by for instance checking the destruction of used pathogens after their use in laboratory work, or controlling the movements of strains and personnel in and out the collections. These special forces would consolidate the security systems provided by international assistance at these facilities.

Reinforce the second line of defense

Illicit trafficking of BW material or equipment cannot be efficiently prevented without training properly customs officials at the borders. As it is not conceivable to train all customs officials, for technical and financial reasons, a brigade of specialized customs men could be created. These customs men would receive a training concentrating on ways to identify, alert and respond to incidents at the borders involving pathogens or BW production equipment. These men could be dispatched at the border control points presenting the greatest risks (close to or on drug/arms trafficking routes, terrorism routes, etc.). In addition, booklets showing equipment used in the development and production of BW, forms in which pathogens are preserved, or containers in which they can be transported or conserved, could be designed and distributed to all border control points.

Develop a unified legislation /regulations of exchanges and transfers of strains

Control over dangerous pathogens can also be reinforced by the development of a proper legislation, regulating the in-country exchanges of pathogens as well as their export. This can be achieved by the creation of national registries where movements of pathogens between institutes would be recorded. Such a registry would not by itself prevent diversions or re-sell of pathogens. However, it would help tracing the origin and movement of a pathogen involved in an incident.

As FSU facilities still cooperate in their research programs, the harmonization of national regulations would increase the efficiency of national legislations in preventing proliferation.

Study the whereabouts of former BW personnel

Finally, there is an urgent need to investigate the whereabouts of former BW personnel who quit their facilities. Such analysis is essential to measure the extent of the brain drain threat and determine how much of it has already occurred. Considering that much of the official data have been lost or scattered among different agencies after the break-up of the USSR, the most efficient way to gather such information is to commission facilities to conduct such studies. Although they do not always have the data required, their representatives quite often keep in touch with their former colleagues and can trace their movements. They also have a better idea of how many specialized personnel worked in the past in their facilities and what where their expertise. The U.S. Department of Defense plans to commission such a study from the Vector facility in Russia. Such projects should also be developed in other facilities.

