

*Feature*Bulletin of the Atomic Scientists
67(4) 78–90

© The Author(s) 2011

Reprints and permissions:

sagepub.co.uk/journalsPermissions.nav

DOI: 10.1177/0096340211413752

<http://thebulletin.sagepub.com>

Biosecurity 2.0: Enduring threats in the former Soviet Union

Marina Voronova-Abrams

Abstract

For the past 20 years the international community concentrated its biological nonproliferation programs in the former Soviet Union. As a result, most of the Soviet bio-warfare infrastructure has dissolved; pathogen collections are in secure storage; scientists have engaged in peaceful cooperative research; and local disease surveillance capabilities have improved. Major international donors have recently begun shifting their biological threat reduction efforts to countries in Africa and Southeast Asia to address growing threats of terrorism and disease there. While there are good reasons for a shift in geographical focus, the international community should not ignore the remaining challenges in the former Soviet Union—such as training a new generation of specialists, strengthening personnel policies to prevent “insider” threats, and improving transparency and multilateral communication. With continued support, scientists from the former Soviet countries can make valuable contributions to nonproliferation and public health programs worldwide.

Keywords

biosecurity, bio-warfare, Caucasus, Central Asia, emerging diseases, epidemiology, funding, nonproliferation, public health, Russia, Soviet Union, terrorism, threat reduction

The announcement sent ripples throughout the international health community: On April 23, 2010, the World Health Organization (WHO) confirmed that seven children suffering from paralysis in the poor former Soviet country of Tajikistan were victims of poliomyelitis. Genetic sequencing showed that the virus had probably arrived with a traveler from India. It was the first importation of polio into Europe since 2002, when the region was certified as polio-free.¹

The outbreak rapidly spilled over into neighboring Kazakhstan, Russia, and Turkmenistan, causing 476 laboratory-confirmed cases, including 29 that were fatal (Centers for Disease Control and Prevention, 2011). WHO warned that there was a high risk of further cross-border spread of the crippling and extremely contagious illness.

High rates of immunization—90 percent or more—are required to stop the spread of polio, for which there is no cure. WHO partnered with the United

Nations Children's Fund (UNICEF) and the US Centers for Disease Control and Prevention (CDC) to contain the outbreak. Together these organizations provided oral polio vaccine for more than 25 million children in the region over several rounds of national immunization days (World Health Organization, 2011).

Polio is just one of many serious biological threats that public health systems face in the former Soviet Union. Not only must these underfunded systems detect and contain naturally occurring diseases such as plague, anthrax, and cholera but they are also charged with responding to a potential terrorist bio-attack. And they are responsible for safeguarding dangerous pathogens that are used for laboratory research, which could threaten human health and agriculture if accidentally or intentionally released. The public health systems in the former Soviet Union constitute a vital link in the international biological monitoring and response network—one that can easily atrophy without ongoing efforts to maintain it.

For two decades, the post-Soviet region has been a priority for international attention and funding because of its former clandestine biological warfare program, which notoriously exploited a broad range of civilian public health and agriculture institutions.² Despite significant progress over the past 20 years in securing research facilities, redirecting scientists to peaceful projects, and improving disease surveillance capabilities, major challenges remain—particularly in training a new generation of epidemiologists, strengthening personnel policies to prevent unauthorized use of pathogens, and increasing cooperation between nations.

Growing transnational threats of disease and terrorism in other parts of the world have prompted international donors to move into Africa and Asia.³ The former Soviet Union continues to face similar threats; but despite serious and long-standing needs to address these multifaceted problems, international partners seem to lack both a long-term strategy for the region and the ability to convey a clear message to the experts on the ground about whether the partnerships are to continue—and, if so, within what framework. Consequently, it is unclear whether program budgets will include any support for activities in the former Soviet Union beyond 2015.

Two decades of progress

When the Soviet Union collapsed in 1991, its secret biological warfare program was suddenly revealed in its full scope. Only then did the international community realize that this vast country had approximately 70 facilities and about 60,000 scientists dedicated to the research and production of deadly biological weapons (Woolf, 2010).

The United States and other countries allocated about \$1 billion between 1993 and 2011⁴ to international programs to counter the biological proliferation risks posed by the legacies of the Soviet Union.⁵ The earliest projects focused on the dismantlement and elimination of the former Soviet Union's bio-warfare infrastructure, such as production facilities in Berdsk (Russia) and Stepnogorsk (Kazakhstan)—both capable of producing hundreds of tons of deadly biological material in a matter of months (Cook and Woolf, 2002).

Every former Soviet republic hosted collections of biological pathogens, required for day-to-day epidemiological work on naturally occurring human and animal diseases in the region—such as plague, tularemia, anthrax, cholera, and foot-and-mouth disease. Most facilities storing these collections, however, had very poor security. The US and its international partners helped the newly independent republics relocate and consolidate the pathogen collections to new or renovated buildings with alarm systems and guards to prevent unauthorized access. Physical security upgrades took place at bacterial research institutes, animal vaccine production facilities, and a viral research institute that was one of only two smallpox repositories in the world (Weaver, 2010).

Consolidation was especially important within the anti-plague system. In Kazakhstan alone, this system has one central research institution, 10 regional and 19 field stations, and 47 seasonal laboratories. Before the consolidation process, most regional and field stations had accumulated their own collections through years of work. Now they keep only a limited number of strains for research and monitoring needs while sending the rest to a central repository (Department of Defense, various years).

A newly built central reference laboratory in Ukraine in 2010 and another in Georgia in 2011 have improved disease surveillance and empowered local experts with scientific capabilities. Azerbaijan, Kazakhstan, and Kyrgyzstan are scheduled to construct their own central reference laboratory within the next two years (Chemical Demilitarization, 2010; US Embassy in Ukraine, 2010; US Embassy in Kazakhstan, 2011; Civil Georgia, 2011;

UK Global Threat Reduction Program, 2011; Defense Threat Reduction Agency, 2010).

The United States and other countries have also sponsored biosafety projects aimed at preventing the accidental release of pathogens inside the laboratory. These projects have introduced former Soviet scientists to international biosafety regulations and provided their labs with modern safety cabinets.

After the disintegration of the Soviet Union, thousands of highly talented defense-oriented researchers found themselves unemployed or working in deteriorated conditions. Cooperative research projects minimized the incentives for these scientists to continue their work on biological weapons, by integrating them into legitimate international science and business communities. As a result, the region's scientists finally emerged from their Cold War isolation to collaborate with foreign partners and publish their research findings in international journals. As one Pentagon official put it: "Every hour these experts spend on peaceful civilian research projects is an hour not spent in development of weapons of mass destruction" (US GAO, 1995: 54).

Current challenges

The Soviet bio-warfare program no longer poses a danger to international security, and in that sense threat-reduction programs for the region have become obsolete. But the new century has seen an increase in transboundary threats from disease and terrorism. The major challenge to the international community is to secure every region against these threats. Missing one patch of the geographical quilt leaves all other

areas vulnerable, because of the ease of global travel, labor migration, and international communications. The former Soviet Union is one of the largest patches to cover, and one that continues to experience ongoing challenges from both terrorism and disease.

Challenge no. 1: Disease

Regional epidemiological threats require continued, robust monitoring and response. A number of dangerous diseases—such as plague, brucellosis, and Crimean-Congo hemorrhagic fever—are endemic, and in some instances hyper-endemic, to areas within the former Soviet states. These are zoonotic diseases, transmissible from animals to humans. Outbreaks in humans occur every year and remain small only because of timely containment measures.

For example, only 23 people contracted plague in Kazakhstan between 1991 and 2010 (Turegeldieva, 2011, personal communication), seemingly a small number. Had local epidemiologists failed to contain the outbreaks, however, this disease could have spread throughout the entire region.

Additional examples from the region further illustrate the risks. Just last year a scandalous outbreak of anthrax occurred in Omsk Province, Russia, where a local slaughterhouse butchered 18 clearly ill horses, in violation of health regulations, and sold the meat to a local prepared-foods company. Six employees of the slaughterhouse became sick, and one of them died in the hospital; 127 other people were put on a two-week quarantine; and the prepared-foods company had to recall 195 metric

tons of its product (ITAR-TASS, 2010; *Komsomolskaya Pravda*, 2010).

Brucellosis has become a serious problem in all of the Central Asian republics, where the number of cases is growing every year. In Kazakhstan, for example, more than 2,500 people contract this disease annually. In the southern Caucasus, Armenia registered 289 cases in 2008, compared with only 101 cases a decade earlier (Saakyan et al., 2010; Kazakh Zerno, 2009; Tihonov, 2009).

Traditional agricultural practices and animal husbandry have always kept epidemiologists busy, but growing urbanization, industrialization, and mineral and oil exploration are bringing human populations into closer contact with once-wild areas, increasing the risks of infection. In Kazakhstan, for example, gerbil populations have spread all along the country's new railway lines and pipelines. Elevated track beds and pipeline supports shed water and create artificially dry habitats that are more hospitable to these rodents. As a result, over the past decade, the expanding gerbil population has raised the risk of transmitting plague from this host to humans (Aikimbaev, 2010; Ospanov, 2010).

Labor migration and international travel put additional burdens on epidemiologists to detect imported diseases and contain local outbreaks. Cholera, for instance, has become a frequent visitor to the former Soviet region, coming from Afghanistan, China, India, Pakistan, Turkey, and other countries.

Challenge no. 2: Terrorism

The rise of militant Islamic groups has introduced a new threat to the region.

Decades before 1991, during the aggressively atheist Communist era, traditional Islam transformed into political radicalism, creating the religious “underground.” These movements became further radicalized during the political and economic turmoil of the late 1980s and began resorting to terrorist methods in the 1990s. Some of these groups established international contacts and are believed to have the support of transnational terrorist networks such as Al Qaeda (Abdovakhitov, 1993; Babadzhanov, 2002; UN Office for the Coordination of Humanitarian Affairs, 2004). Islamic extremists actively participated in the civil war in Tajikistan (1992–1997) and the First (1994–1996) and the Second (1999–2000) Chechen Wars. Islamist insurgencies also destabilized the Batken region in Kyrgyzstan in 1999 and 2000. Recurring terrorist acts in Russia, and current insurgencies on the Tajik–Afghan border, indicate that these problems show no signs of lessening. In fact, terrorists have become more violent, lethal, and indiscriminate. Regional terrorist groups such as the Caucasus Emirate and East Turkistan Islamic Movement have recently stepped up their activities and are seeking greater influence in Eurasia (*MonTREP*, 2011; International Crisis Group, 2011).

Islamist terrorist groups in the region focus much of their current strategy on social and political grievances rather than questions of religion and ideology. It is unlikely that these regional groups would use biological agents against local populations, nor have they openly expressed any desire to acquire biological weapons. Up to this moment, they have not demonstrated a tendency to “innovate” outside the use of standard weapons.⁶ These trends may change, however, under the influence of more

aggressive and more indiscriminate international terrorist organizations.

Transnational groups, on the other hand, have openly boasted of their intent to acquire and use biological pathogens (Bale, 2004). These groups effectively use local military conflicts—such as those in Tajikistan, Bosnia, Kosovo, Chechnya, and Kashmir—to promote their own agenda (Daftary and Troebst, 2003; Institute of Peace and Conflict Studies, 2003). They provide regionally based terrorist groups with weapons, funds, and training camps. In exchange, regional conflicts become part of the world jihad campaign. It is plausible that international networks could also use their contacts in the former Soviet Union to obtain biological pathogens.

Terrorism and disease threats in the region call for greater international cooperation and reinforced efforts in regional epidemiology and counter-terrorism measures.

Moving forward

Over the next decade, the international programs should address three important issues: professional training, personnel policies, and transparency and communication.

Train more specialists

During the next 20 years, the region will lose an entire generation of world-class Soviet-trained epidemiologists. Without enough specialists on the ground, the region’s public health systems will face increasing vulnerability to natural outbreaks, accidents, or biological terrorist attacks.

Most institutions in the region that work with dangerous diseases are

experiencing long-term human resource problems. In Kyrgyzstan, for example, up to 70 percent of specialists have reached retirement age, and younger experts are filling only a fraction of these vacancies. Opinions vary as to why so few replacements have been trained, but it is clear that higher-education institutions are no longer producing sufficient numbers of qualified professionals. Educational systems in general suffer a chronic lack of funding, and many universities have either closed their sanitary-epidemiological departments or cut the academic hours devoted to epidemiology, biology, microbiology, virology, and immunology. Additionally, working with dangerous pathogens remains a high-risk job but has lost its previous prestige—and the corresponding salaries and benefits. As a result, many young, well-trained specialists are leaving for better-paid jobs in the private sector.

International partners should cooperate with regional governments to resuscitate education and training in the public-health sector, to help ensure that new generations of specialists are trained to address future epidemiological threats. Faculty improvement programs at local universities and paid internships at designated institutions could attract young scientists. International and domestic organizations such as national academies of sciences, WHO, World Bank, and the Biosafety Association for Central Asia and the Caucasus (BACAC) should also pressure the region's governments to increase budget allocations for scientific research institutions responsible for disease monitoring and outbreak containment.

Strengthen personnel policies

Most experts in the region admit that current personnel policies are weak, which increases the risk that authorized personnel could misuse their access to hazardous biological agents. Background checks and psychological evaluations are usually not required for employment at facilities housing dangerous pathogens. Soviet-era labor laws prevent managers from dismissing employees even if they exhibit suspicious behavior or create tension among colleagues.

While building reference laboratories, installing alarm systems, and establishing cooperative research projects in the former Soviet Union, international programs failed to seriously address the potential for “insider” threats. The Soviet legacy of personnel management has thus far kept such risks in check. Soviet institutions tended to be clustered, family-like communities where everybody knew each other and spent their free time together discussing each other's problems in detail. In other words, the formal work environment created an informal, social safety net that served as a screening program. Strict oversight by the security services provided additional safeguards.

Today's university graduates are more individualistic than communal in social outlook; they are more profit-oriented than idealistic; they change jobs frequently; and they do not share their parents' fear of the secret services. The formal and informal checks and balances of the Soviet system no longer work, and these changes must be reflected in reformed personnel policies at the region's facilities.

The absence of reliable background checks benefits terrorists, should they plan to steal a strain or gain access to culture fermentation technologies. It would be easy enough for terrorist groups to send sleeper agents to these facilities, or to find willing collaborators in exchange for financial incentives.

The US and Europe have held vigorous, frequent, and multidisciplinary discussions on this issue since 2001, engaging both governments and academia (AAAS, 2010; National Research Council of the National Academies, 2009b; NSABB, 2011; Rappert, 2010). International biological threat reduction initiatives should include the former Soviet nations in these discussions, and should assist the region's government regulators and facility managers with developing better personnel regulations.

Improve transparency and communication

Despite the obvious benefits of international cooperation, politics and bureaucracy stymie many initiatives. Russia, for example, has denied access to several biomedical research and development facilities and has grown more reluctant to cooperate with other countries on biological research projects. These decisions have isolated Russian scientists and have led to increasing tensions within the Biological Weapons Convention (BWC). Russian officials have justified their actions by citing national security concerns, poor collaboration on the part of Western partners, and a need to address a broader range of diseases than do cooperative international projects.

Without international cooperation, however, Russia will not be able to enter international markets. The pharmaceutical sector in Russia, for example, requires an enormous amount of investment that can only come out of private partnerships, but these partnerships are only possible if there is a certain level of trust within the BWC.

The problem is not only with Russia. In his book *Sanitary Protection of the Territory of Kazakhstan*, Kenes Ospanov, chief physician of Kazakhstan, states that Uzbekistan and Turkmenistan have not shared information on especially dangerous diseases, forcing Kazakhstani epidemiologists to use obsolete data. In one case, experts had to rely on basic Internet searches for information about plague and anthrax outbreaks in Turkmenistan (Ospanov, 2010: 138–139). Timely epidemiological information is critical for effectively containing outbreaks. Without it, epidemiologists must devote more financial and human resources to monitoring border areas, where populations are at greater risk.⁷

An additional obstacle is the inability of international stakeholders to adapt their partnerships to evolving security challenges. Most of the threat-reduction programs were founded as bilateral agreements with rigidly established and hierarchical communication procedures. Recently, however, these programs have been developing into more flexible and multidisciplinary frameworks. One such example is the BWC Intersessional Process, which has allowed both State Parties and experts from all over the world to openly discuss a wide range of issues—from legislation to public health to acts of terrorism.

Most of the former Soviet republics have been very slow or unable to adapt to these multidisciplinary frameworks.⁸

It is vital that these states improve their intergovernmental sharing of public health data. Political leaders in the former Soviet Union need to understand that public health requires transparency among neighbors and that reporting outbreaks is a matter of regional and international security, not of mutual suspicion.

The international community should continue to engage the region, and Russia in particular, if not through bilateral programs, then through multilateral forums such as WHO and BWC and through private partnerships aimed at meeting Russia's needs for public health and economic development. More important, governments need to send clear signals that new frameworks, such as the BWC Intersessional Process, matter. Russia, in turn, should demonstrate its goodwill toward the international community by voluntarily reopening access to its facilities.⁹ This would go a long way toward reversing the trends that are hindering dialogue within the BWC and undermining international pharmaceutical and biomedical investment in Russia.

Valuable partners

Partnerships with former Soviet scientists are valuable not only for addressing ongoing challenges and concerns in the region but also for defeating diseases and terrorist activities outside the region. Soviet-trained experts have the potential to be excellent mediators in biosecurity and biosafety initiatives in other regions. Common geographical and historical links with Asia often

translate into shared cultural values, not to mention common endemic diseases and security issues. For this reason, for example, it was quite natural for Afghanistan, Mongolia, and Pakistan to participate in the meetings of the Biosafety Association for Central Asia and the Caucasus.¹⁰

In addition, public health specialists in the former Soviet states face practical challenges similar to those encountered in other areas—including parts of Southeast Asia and Africa, where international concerns are now focused. Epidemiologists in Central Asia and the Caucasus, for example, often work in harsh, low-tech field conditions where European and Western standards simply do not apply on the ground. These epidemiologists can help their Asian and African counterparts by sharing not just their customary practices but also their tacit knowledge—important skills held by individuals and not necessarily expressed on paper (Ben Ouagrham-Gormley and Vogel, 2010).

In most countries veterinarians, physicians, and ecologists work in separate worlds and seldom cooperate. This division has lately become a point of criticism, with more and more experts calling for all-inclusive collaborations. The former Soviet Union's anti-plague system deserves international attention for its interdisciplinary approach to dealing with infectious, and especially zoonotic, diseases.¹¹ Veterinarians, parasitologists, medical doctors, and ecologists have worked closely within this system for more than 60 years, both in the laboratory and in seasonal field units, to find ways to prevent and control outbreaks. It could well be this holistic approach that has enabled public health officials to contain outbreaks

successfully, even under poor economic conditions, in a region where so many dangerous diseases are naturally occurring. The One Health Initiative, an international movement founded in 2007, is working to promote interdisciplinary strategies to address health issues.¹² But years before One Health was founded, former Soviet experts pioneered this approach; thus, it would be reasonable and desirable that international partners invite them to share their practices of integrating multiple disciplines in public health.

Conclusion

Both terrorists and diseases infiltrate society invisibly. They are difficult to detect and do not respect national borders. The former Soviet Union remains a region requiring attention and funding to address these transnational threats. The international community must continue to engage the countries of this region and bring them into fully international—rather than bilateral or regional—efforts.

Global security is not simply about shifting funds from one region to another, but rather about using available funds wisely for the most comprehensive coverage and closely coordinating with all partners. Continued funding in the former Soviet Union requires innovative, carefully crafted programs and engagement of a wider, and perhaps different, set of implementing organizations. These new programs may not necessarily all go under the label of “threat reduction,” but rather could fall within the areas of education and public health. They need not be expensive

programs, because they do not require new construction or demolition activities.

The United States and its international partners should develop a long-term strategy for the region with regard to biosecurity and biosafety. The top priority is to immediately start explicit discussions with local experts and government officials about new kinds of cooperation. Both donors and recipients need to have a clear idea of what will happen to existing partnerships in the next 10 to 15 years, what the expectations are on both sides, and how the partners can build on the work of the previous decades in future projects.

Acknowledgements

The author would like to express her great appreciation to Lela Bakanidze (National Center for Disease Control in Georgia), Dzhahalidin Gaibulin (Republican Center of Quarantine and Especially Dangerous Infections in Kyrgyzstan), Aleksander Haitovych (Ukrainian Anti-Plague Station), and Dinara Turegeldieva (M. Aikimbaev Kazakh Science Center for Quarantine and Zoonotic Diseases) for their cooperation and willingness to answer questions. Their valuable comments, although not quoted in the article, helped the author to better understand the situation in the region.

Notes

1. According to the classification of the World Health Organization, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan belong to the European region.
2. One of the key features of the Soviet biowarfare program was the utilization of ostensibly civilian facilities, which provided an ideal cover for illicit biowarfare activity. The main part of the biowarfare program, Biopreparat, was incorporated within the Main Administration of the Microbiological Industry under the Council of Ministers (Glavmikrobioprom), responsible for the nascent biotechnology industry. Biopreparat comprised some

- 40 research and development and production facilities. The USSR Ministry of Agriculture concealed a program code-named “Ekologiya” (“Ecology”) and managed six specialized research institutes to develop anti-animal and anti-plant offensive biological weapons. The anti-plague research institutes and field monitoring stations were mainly responsible for civilian epidemiological investigations, but the institutes also developed vaccines against, and diagnostic materials for, microbial pathogens modified by the military (Bozheyeva et al., 1999; Rimmington, 2000).
3. Members of the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction have expanded their assistance to countries in Africa and Asia with projects on biosecurity and biosafety training, disease surveillance, and development of international scientific ties, as well as BWC enforcement and national legislation to combat bioterrorism (Biosecurity Engagement Program (BEP), 2009; DTRA, 2010; European Union, 2010; Lugar, 2010; UK Statement, 2009).
 4. The exact numbers are hard to calculate due to the variety of state programs, inconsistent financial reporting systems, and different mechanisms for administering funding. In many publicly available expenditure reports (especially those from the 1990s), biosecurity-related projects are part of broader program areas, which also include chemical and nuclear nonproliferation activities. Programs such as “Redirection of Scientists” and “Weapons of Mass Destruction Infrastructure Elimination” are good examples of such reporting. In addition to the government programs, the nongovernmental organization Nuclear Threat Initiative provided more than \$5 million for biosecurity and biosafety projects in the former Soviet Union between 2001 and 2009. The author made her calculations based on the following sources: Global Partnership Working Group—GPWG. Annual Report, 2011; Defense Threat Reduction Agency (DTRA), 2010; Department of Defense, Cooperative Threat Reduction. Annual Reports to Congress; US GAO, 1995, 2000; International Science and Technology Center, various years. Annual reports; Civilian Research and Development Foundation (CRDF) Global. Annual reports; National Research Council of the National Academies, 2009a; UK Global Threat Reduction Program, 2010, 2011; Department of Foreign Affairs and International Trade of Canada (DFAIT), 2009; Nuclear Threat Initiative, various years. Annual reports; Tarnoff, 2006).
 5. The United States was the first country to initiate the Cooperative Threat Reduction Program in 1992 to counter the risks of proliferation posed by the legacies of the Soviet Union. It quickly became evident that the volume of work required greater international participation, and the US encouraged other allies to contribute to these projects. Eventually the EU, UK, Japan, South Korea, and Canada joined, as did others. In 2002, the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, with now 23 partner states, became the primary mechanism, although the US remains the largest contributor (90 percent of the total amount) to assistance in the biological field. The US Cooperative Threat Reduction Program engages the US Department of Defense, Department of State, Department of Energy, Centers for Disease Control and Prevention, Agency for International Development (USAID), Department of Health and Human Services, Department of Agriculture, and the Environmental Protection Agency.
 6. In his book *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons*, Jonathan Tucker points out that one of the characteristics of terrorists who are likely to resort to chemical and biological agents is a “certain degree of innovation in designing weapons and carrying out attacks. . . . since the use of poison or disease represents a departure from traditional terrorist activity, groups that are considering such weapons are likely to be more creative in their thinking about violence” (Tucker, 2000: 256). Central Asian

- terrorist groups participated in conventional armed conflict in Tajikistan and insurgencies in Kyrgyzstan and used conventional bombing methods. The recent suicide bombings could be interpreted as a new kind of attack, but they are most likely a result of “copying” Middle Eastern terrorist groups’ tactics.
7. Often, countries avoid official recognition of disease outbreaks. Thus, during a 2010 polio outbreak, Uzbekistan did report 147 cases of acute flaccid paralysis (AFP), which can be a symptom of polio, but the government waited four months to send only 15 stool samples to accredited WHO laboratories for confirmation analysis; all were negative for poliovirus. Many of the AFP cases in Uzbekistan occurred near the borders with Tajikistan, Turkmenistan, and Kazakhstan. This was a logical indication for epidemiologists that polio transmission in Uzbekistan could not be excluded (National Travel Health Network and Centre, 2010; World Health Organization, 2011).
 8. The reasons why the former Soviet republics have been slow to adapt to multidisciplinary frameworks include: (1) a lack of human resources within the responsible government agencies; (2) a political culture of strict vertical hierarchies that discourages horizontal communication across agencies; (3) internal confusion over which government agency is responsible for such collaboration, whether it is the Ministry of Foreign Affairs or the Ministry of Health; (4) a reluctance to consult with experts outside the government agency; and (5) the failure by international partners to communicate the importance of the new framework as a new way to continue partnerships.
 9. The BWC does not have a verification regime. Therefore Russia is not legally obliged to give access to its biomedical R&D facilities.
 10. In 2008 regional experts established BACAC to promote biosecurity and biosafety in the region and to share best practices. Please see more information about BACAC at www.bacac.org.
 11. Plague in this sense was used to refer not just to the disease caused by *Yersinia pestis* but also to other dangerous diseases. More information about the history of the Soviet anti-plague system, covering the period from the late nineteenth century onward—including its accomplishments, organization, work programs, and responsibilities—is available in the study by Ben Ouagrham-Gormley et al. (2008).
 12. Please see more information about One Health Initiative at www.onehealthinitiative.com.

References

- Abdovakhitov A (1993) Islamic revivalism in Uzbekistan. In: Eickelman D (ed.) *Russia's Muslim Frontiers*. Bloomington, IN: Indiana University Press, 79–100.
- Aikimbaev A (2010) *Osnovy biologicheskoi bezopasnosti* (Foundations of Biological Security). Almaty: IP Volkova E.V.
- American Association for the Advancement of Science (AAAS) (2010) Competing responsibilities? Addressing the security risks of biological research in academia. Available at: <http://cstsp.aaas.org/content.html?contentid=2331>.
- Babadzhanov B (2002) Islam in Uzbekistan: From the struggle for religious purity to political activism. In: Rumer B (ed.) *Central Asia: A Gathering Storm?* Armonk: ME Sharpe, 299–321.
- Bale J (2004) Islamism. In: Pilch R and Zilinskas R (eds) *Encyclopedia of Bioterrorism Defense*. New York: Wiley-Liss, 296–298.
- Ben Ouagrham-Gormley S and Vogel K (2010) The social context shaping bioweapons (non)proliferation. *Biosecurity and Bioterrorism: Biodefense Strategy, Practice, and Science* 8(1): 9–24.
- Ben Ouagrham-Gormley S, Melikishvili A, and Zilinskas R (2008) The Soviet anti-plague system. Available at: <http://cns.mii.edu/antiplague/index.htm>.
- Biosecurity Engagement Program (BEP) (2009) U.S. Department of State, Bureau of International Security and Nonproliferation, Office of Cooperative Threat Reduction. Poster at the 2009 Meeting of States Parties to the BWC. Available at: [www.unog.ch/80256EDD006B8954/\(httpAssets\)/AC62AD24E72364CEC125764600494E33/\\$file/BWC_MSP_2009_MX-Poster-BEP.pdf](http://www.unog.ch/80256EDD006B8954/(httpAssets)/AC62AD24E72364CEC125764600494E33/$file/BWC_MSP_2009_MX-Poster-BEP.pdf).
- Bozheyeva G, Kunakbayev Y, and Yeleukenov D (1999) Former Soviet biological weapons facilities

- in Kazakhstan: Past, present, and future. James Martin Center for Nonproliferation Studies. Occasional Paper 1, June.
- Centers for Disease Control and Prevention (2011) Polio outbreak in Tajikistan, cases in Russia, risk of spread to other Central Asian countries. October 22. Available at: <http://wwwnc.cdc.gov/travel/content/outbreak-notice/polio-tajikistan-russia-central-asia.aspx>.
- Chemical Demilitarization (2010) Bio-threat reduction program in Azerbaijan. April. Available at: http://www.hnd.usace.army.mil/pao/PAO_Fact_Sheets/Chemical%20Demilitarization-April%20%202010.pdf.
- Civil Georgia (2011) U.S.-Funded 100 mln bio lab opens in Tbilisi. Civil.ge Daily News Online, March 11. Available at: <http://www.civil.ge/eng/article.php?id=23257>.
- Civilian Research and Development Foundation (CRDF) Global (various years) Annual reports. Available at: www.crdf.org/annualreport/annualreport.htm.
- Cook M and Woolf A (2002) Preventing proliferation of biological weapons: U.S. assistance to the Former Soviet States. Congressional Research Service, April 10. Available at: www.fas.org/spp/starwars/crs/RL31368.pdf.
- Daftary F and Troebst S (eds) (2003) *Radical Ethnic Movements in Contemporary Europe*. New York: Berghahn Books.
- Defense Threat Reduction Agency (DTRA) (2010) Fiscal year 2011 budget estimate cooperative threat reduction program. Available at: http://comptroller.defense.gov/defbudget/fy2011/budget_justification/pdfs/or_Operation_and_Maintenance/O_M_VOL_1_PARTS/DTRA_FY11.pdf.
- Department of Defense (various years) Cooperative Threat Reduction. Annual Reports to Congress.
- Department of Foreign Affairs and International Trade of Canada (DFAIT) (2009) Fighting terrorism and weapons of mass destruction. Report to Parliament 2007–2009. Available at: http://www.international.gc.ca/gpp-ppm/media/report-rapport_gpp-ppm_2007-2009.aspx?lang=eng.
- European Union (2010) European Union cooperative initiatives to improve biosafety and biosecurity. Statement at the Meeting of Experts to BWC, August 12.
- Global Partnership Working Group (2011) GPWG Annual Report.
- Institute of Peace and Conflict Studies (2003) Jammu and Kashmir. Seminar report 85. Available at: www.ipcs.org/seminar/jammu-kashmir/kashmir-the-current-situation-578.html.
- International Crisis Group (2011) Tajikistan: The changing insurgent threats. Asia Report 205. May 24. Available at: www.crisisgroup.org/en/regions/asia/central-asia/tajikistan/205-tajikistan-the-changing-insurgent-threats.aspx.
- International Science and Technology Center (various years) Annual reports. Available at: istc.ru/istc/istc.nsf/va_WebPages/AnnualReportsEng.
- ITAR-TASS (2010) Voprosy epidemiologicheskogo blagopoluchiya in RF (Epidemiological welfare in Russian Federation). Press conference with Gennadiy Onishchenko. December 23. Available at: www.itar-tass.com/prnt.html?NewsID=15809456.
- Kazakh Zerno (2009) *Sredi stran SNG po zabolevayemosti brutsellyozom Kazakhstan zanimayet vtoroye mesto posle Kyrgyzstana* (Among countries of the CIS, Kazakhstan is only second to Kyrgyzstan in number of brucellosis cases). March 14. Available at: http://www.kazakh-zerno.kz/index.php?option=com_content&view=article&id=5321&catid=18&Itemid=75.
- Komsomolskaya Pravda (2010) Articles covering an outbreak in Omsk Oblast' of Russian Federation. August–October. Available at: <http://kp.ru/daily/24533/678018/>.
- Lugar R (2010) Lugar takes Nunn-Lugar arms control to Africa. Press release, November 11. Available at: <http://lugar.senate.gov/record.cfm?id=328460&>.
- MonTREP (2011) Islam, Islamism and politics in Eurasia report. January 32(13). Available at: <http://www.mii.edu/academics/faculty/ghahn/report>.
- National Research Council of the National Academies (2009a) *Countering Biological Threats: Challenges for the Department of Defense's Nonproliferation Program Beyond the Former Soviet Union*. Washington, DC: The National Academies Press.
- National Research Council of the National Academies (2009b) *Responsible research with biological select agents and toxins*. Washington, DC: The National Academies Press.
- National Science Advisory Board for Biosecurity (NSABB) (2011) Public consultation on guidance for enhancing personnel reliability and strengthening the culture of responsibility at the local level. January 5. Webcast available at: <http://videocast.nih.gov/summary.asp?Live=9840>.
- National Travel Health Network and Centre, NaTHNaC (2010) Clinical Updates, October 20. Available at: http://www.nathnac.org/pro/clinical_updates/polio_ru_central_asia_201010.htm.
- Nuclear Threat Initiative (various years) Annual reports. Available at: www.nti.org/b_aboutnti/b8_annualreports.html.

- Ospanov K (2010) *Sanitarnaya Okhrana Territorii Kazakhstana (Sanitary Protection of the Territory of Kazakhstan)*. Astana: IP Volkova A.V.
- Rappert B (ed.) (2010) *Education and Ethics in the Life Sciences: Strengthening the Prohibition of Biological Weapons*. Canberra: The Australian National University.
- Rimington A (2000) Invisible weapons of mass destruction: The Soviet Union's BW Programme and its implications for contemporary arms control. *Journal of Slavic Studies* 13(3): 1–46.
- Saakyan L, Manrikyan M, and Movsesyan A (2010) Legislative, structural, and sectoral control and response to biological threats in Republic of Armenia. Presentation at the international seminar *Public Health, Security, and Law Enforcement Partnership in Bio Incident Pre-Planning and Response*. May 11–12. Tbilisi, Republic of Georgia.
- Tarnoff C (2006) U.S. assistance to the Former Soviet Union. Congressional Research Service, March 16.
- Tihonov V (2009) Brucellosis: Epizootic situation in Kazakhstan. *Vetmedical*. January 28. Available at: vetmedical.ru/forum/t3691.html.
- Tucker J (2000) *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons*. Cambridge, MA: MIT Press.
- UK Global Threat Reduction Program (2010) Seventh Annual Report 2009. February 17. Available at: http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/nuclear/nonprolif/global_threat/reports/ann_repts/ann_repts.aspx.
- UK Global Threat Reduction Program (2011) Eighth Annual Report 2010. March 8. Available at: <http://www.decc.gov.uk/publications/DirectoryListing.aspx?tags=35>.
- UK Statement (2009) UK activities on international cooperation and assistance promoting capacity building in the fields of disease surveillance, detection, diagnosis and containment of infectious diseases. Meeting of Experts to BWC, July 27.
- UN Office for the Coordination of Humanitarian Affairs (2004) Central Asia: Focus on security threat from radical Islamic groups. November 14. Available at: www.irinnews.org/report.aspx?reportid=22725.
- US Embassy in Kazakhstan (2011) Central Reference Laboratory in Almaty. Press release, January 19. Available at: <http://kazakhstan.usembassy.gov/pr-01-19-11.html>.
- US Embassy in Ukraine (2010) DOD commissions first bio-safety laboratory in Ukraine. Press release, June 15. Available at: www.Ukraine.usembassy.gov/dtro-biosafety.html.
- US Government Accountability Office (GAO) (1995) Weapons of mass destruction: Reducing the threat from the Former Soviet Union: An update. June.
- US Government Accountability Office (GAO) (2000) *Biological Weapons: Efforts to Reduce Former Soviet Threat Offers Benefits, Poses New Risks*.
- Weaver M (2010) Biosafety and biosecurity activities of the International Science and Technology Center in the Republics of the Former Soviet Union: Accomplishments, challenges, and prospects. *Applied Biosafety* 15(2): 56–59.
- Woolf A (2010) Nonproliferation and threat reduction assistance: U.S. programs in the Former Soviet Union. Congressional Research Service, February 4. Available at: www.fas.org/srg/crs/nuke/RL31957.pdf.
- World Health Organization (2011) WHO Epidemiological Brief (12). February 7. Available at: www.euro.who.int/__data/assets/pdf_file/0003/132807/WHO_EPI_Brief_7_Feb_2011e.pdf.

Author biography

Marina Voronova-Abrams is a program associate at Global Green USA. Throughout her career she has participated in multidisciplinary projects dealing with the physical protection of nuclear and biomedical facilities and with employment issues for former Soviet biological warfare scientists. She worked for more than five years at the James Martin Center for Nonproliferation Studies as Research Associate at the Chemical & Biological Weapons Nonproliferation Program in Monterey, California and as Office Manager at the representative office in Almaty, Kazakhstan. She was also involved in establishing a state-of-the-art biomedical facility in Russia while working as a lead researcher and analyst at Investment Advisory Group International LLC in Moscow. She holds an MA in International Policy Studies from the Monterey Institute of International Studies and is a member of Women in International Security (WIIS).