

Biosafety and Biosecurity Activities of the International Science and Technology Center in the Republics of the Former Soviet Union: Accomplishments, Challenges, and Prospects

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The International Science and Technology Center (ISTC; www.istc.ru) is an intergovernmental organization promoting international scientific cooperation with a nonproliferation component. It was formed in 1992 by the governments of the United States (U.S.), European Union (EU), Japan, and Russia. Other countries subsequently joined. Current Parties providing funding to the ISTC are Canada, the EU, Japan, Korea, and the U.S. Parties that receive funding are Armenia, Belarus, Georgia, Kazakhstan, The Kyrgyz Republic, Russia, and Tajikistan. The ISTC's core mission is funding science-related activities and assisting researchers in integrating into the international scientific community. Activities funded include research projects, workshops, training, conferences, travel, communications support, commercialization support, and infrastructure upgrades. The initial focus of the ISTC was on nuclear and chemical scientists and projects, but biological sciences are a growing component of its work. In 2008, 22% of total project funding (about \$5.5 million out of \$26 million) was allocated to work involving biology and other life sciences. In the past 15 years over \$191 million was spent in this area.

Research involving pathogens, and associated biosafety issues, is relevant to the ISTC for several reasons. The first is that the Soviet Union ran a large biological weapons program (e.g., Alibek & Hendelman, 1999; Miller et al., 2001). The demise of the Soviet Union left many bioweaponers and related scientists unemployed or underemployed. ISTC projects were intended to assist these scientists to redirect their talents. The breakup of the Soviet Union also left many civilian institutes that work with dangerous pathogens poorly funded, and frequently poorly maintained and secured. This was/is a particular problem in the Central Asian and Caucasian republics, both because they are poorer than Russia and because many dangerous diseases are endemic to the region (e.g., plague, anthrax, hemorrhagic fever viruses, foot-and-mouth disease, brucellosis, and others). This makes it necessary for the human and animal health sectors to work with such pathogens, and means that they are relatively prevalent in both laboratories and the environment, raising proliferation concerns (bottom figure on cover). A related reason that biology is relevant to

the ISTC is that there is a growing awareness among policy makers that emerging and reemerging diseases are a threat to all and need to be tackled regionally or internationally. The ISTC, with its presence in the region and project management infrastructure, is in a position to "leverage" its nonproliferation mission to address these issues. Finally, the 2005 revisions of the WHO international health regulations (WHO, 2005) mandate States Parties to "develop, strengthen, and maintain" their disease surveillance capacities. World Health Assembly resolution 58.29 from the same year calls on Member States to strengthen laboratory biosafety, and urges the international community to help (WHA, 2005). The ISTC is one mechanism through which the international community can assist the countries in which it works to meet these goals.

The ISTC has funded a variety of activities that relate, directly or indirectly, to laboratory biosafety and biosecurity. The first ISTC projects with an explicit biosafety component were biosecurity/biosafety projects at Russian institutes, and were funded by the United States through the U.S. Department of Defense. The first began in July 2000. Most of these projects had a major infrastructure component. Examples of work done included the installation of new ventilation systems, upgrades of physical security systems (such as sensors, fences, and locks), installation of pathogen tracking systems, the renovation of rooms and replacement of equipment to facilitate decontamination, the provision of incinerators, and the training of personnel, including training of institute biosafety officers. Institutes engaged included an animal vaccine production facility (that produces vaccines based on highly virulent H5N1 avian influenza, among others), bacterial research institutes with extensive collections of highly pathogenic strains, including anthrax, a plant disease research institute with a large collection of crop pathogens, and a viral research institute that is one of only two locations in the world known to store smallpox. ISTC-sponsored work included upgrades to the smallpox repository itself. There were 9 projects in all, at 7 institutes, totaling over \$18 million. Some of those projects are still active, and the U.S. continues to engage Russia in biosafety issues through the ISTC

(including via programs run by other government agencies, such as the Departments of Health and Agriculture). The U.S. does related work in neighboring Central Asian and Caucasian countries bilaterally.

Currently many ISTC biosafety activities are being funded by the Canadian Global Partnership Program. One example is a program to train and equip specialists in 4 Central Asian and Caucasian countries to certify biosafety cabinets. Traditionally biosafety cabinets were not routinely used in the region, but currently many are being provided by a variety of foreign donors and local governments. Yet most have never been certified, and until this program began there was no local capacity to do so. Projects are currently being developed to use these locally-trained specialists to inventory and certify all the Class II Biosafety Cabinets in the 4 countries. Another gap that is being addressed is in training to actually use the biosafety cabinets, which are sometimes provided by donors with little or no associated instruction. Other examples of biosafety-related activities include the translation of international biosafety literature and guidelines into local languages (currently Russian and Kazakh); the modernization of national biosafety guidelines, which are mostly still based on the Soviet model; the formation of two regional biosafety associations, one for Russia and one for Central Asia and the Caucasus (www.bacac.org); support for the Eurasian activities of the International Advisory Group on Biosafety and Biosecurity; numerous training programs for regional scientists in areas such as basic biosafety, transport of dangerous goods, modern diagnostics for various diseases, containment lab design principles, and others; and the establishment of a regional biosafety training center on the site of an existing regional training center. The Canadian Global Partnership also funds a variety of research projects which do not specifically focus on biosafety, but through which biosafety needs are identified and met. For example, the Kyrgyz Republican Center of Quarantine and Especially Dangerous Infections is an institute with a core mission that includes doing field surveys for "especially dangerous" diseases such as plague, anthrax, and hemorrhagic fever viruses. Through an ISTC arbovirus surveillance project biosafety cabinets and personal protective equipment, and the training to use them, have been provided. This will allow both the work of the project and the core work of the institute to be done more safely. In the Kyrgyz Republic the goal has been to engage all public institutes that work with dangerous pathogens, including those in the Ministries of Health, Agriculture, and the National Academy of Sciences. Funding for such activities has been almost \$9 million dollars. The Canadian Global Partnership is also involved in a large bilateral project with the Kyrgyz Republic to build a secure containment lab in that country. Thus, as is the case with the U.S. Department of Defense, the ISTC is one mechanism through which the Canadian Government is executing a larger program in the region.

The European Union, via the European Commission Directorate General EuropeAid, has recently funded a biosafety program through the ISTC that will focus on training. Components include training at a major state animal health facility in Russia (All-Russian Research Institute of Animal Health), strengthening an existing regional training center in Central Asia, and providing long-term (at least 6 months), advanced training to a limited number of Central Asian scientists in Europe. The training center is located in Almaty, Kazakhstan, at the Kazakh Science Center for Quarantine and Zoonotic Diseases (KSCQZD). It was a major regional training center during the Soviet period for anti-plague workers, receiving students from throughout Central Asia and the Caucasus (Ouaghrham-Gormley, 2006; www.kscqzd.org). Work that will be done there includes a review of the current training program, the refinement of existing courses, the development of new courses, training of trainers to allow them to teach the new courses, procurement of equipment necessary for training, provision of the training itself, and infrastructure improvements to support the training, including renovations to student dormitories. Funding for this work is almost 7 million Euros.

Biosafety is also a growing concern among other ISTC funders that fund biological research projects but do not focus on biosafety *per se*. For example, The United Kingdom funds or co-funds disease surveillance and other biology projects in Georgia, Tajikistan, and Kyrgyzstan. Biosafety is not the overall goal of the projects, but they are given a biosafety review before they begin, and biosafety concerns are addressed. Such projects, and the equipment, materials, training, and opportunity to actually use the training that accompany them, can be extremely useful tools in improving biosafety at host institutes.

One challenge in this work is donor coordination. Many different donors are active in the region, and they do not always coordinate their work. On the whole coordination of work done through the ISTC is good. This is partly because the funders who work through the ISTC tend to know each other, in some cases working together on their larger bilateral programs as well. And it is partly because the mechanism of funneling work through a single organization itself facilitates coordination. One example of this is the training center at KSCQZD referred to above. Both the Canadian Global Partnership and the EU are interested in supporting its long-standing role as a regional training center, with a focus on ways it can strengthen biosafety and biosecurity in the region. Yet there is plenty of work to go around, and a desire to ensure that the programs complement rather than compete with each other. The mechanism of running both programs through one organization helps make that happen. In addition to avoiding overlap good coordination has the added benefit that it can allow experience to be shared. For example, it can sometimes be difficult to identify which local ministries or agencies are relevant to

a given issue, and which officials in them to contact about it. A surprising amount of time and effort can sometimes be spent in finding out. Sharing such information benefits all.

Probably the greatest challenge is sustainability. Different philosophies of biosafety exist in different parts of the world (Chua et al., 2009). “Western” approaches have tended to emphasize equipment and facility design, while under the Soviet Union emphasis was placed on training, procedures, and good bench-top practices. For example, plague work was often (and still is often) done on the open bench-top rather than in a biosafety cabinet, by highly trained workers wearing “anti-plague” suits (top figure on cover). The countries of the former Soviet Union inherited those practices, guidelines, and the legal framework behind them. Biosafety practices derived from both philosophies worked. However, the consensus of both international biosafety experts and the scientists in the former Soviet republics seems to be that under current conditions the old Soviet methods are no longer sufficient, and that greater adoption of international standards and practices would be beneficial. However, there is also a clear understanding among the local scientists that not everything that is affordable in Europe or North America or Japan is affordable in all parts of the former Soviet Union, and so equipment and practices transferred uncritically may not be sustainable without continued external funding (to which few donors are willing to indefinitely commit). Consumable and utility costs are a particular concern in this regard. For example, diagnostics methods that rely on kits imported from America or Europe may be safe and effective, but also unaffordable once the foreign-sponsored project ends. A lack of reagents will sometimes render equipment designed to work with them useless. The author has seen a rather expensive real time PCR machine in a nicely renovated room in a public health facility in Central Asia that had been donated by a foreign embassy and never used, because it was designed to work with a certain kit which was expensive and had not been provided. The person in charge of the machine was trying to figure out how to make her own reagents for it, and was a clever scientist who probably succeeded in the end. But the situation was clearly not ideal. Other examples of potential non-sustainable solutions abound: security lighting imported from abroad by a donor may only be effective until the bulbs start to burn out; local ministries may not be able to pay the steam and electricity bills for labs built or renovated with foreign funding; scientists trained to use disposable inoculating loops may find themselves without any, and without training or equipment to use standard ones safely.

Hence a “hybrid” approach to biosafety would appear to be desirable, in which elements from both local and international approaches are chosen and synthesized, with a particular emphasis on minimizing costs and sourcing as much equipment and materials locally

as possible (Chua et al., 2009). Such an approach should be based on science and risk analysis, and deliver solutions suited to the conditions and budgets of the countries in which they will be deployed. Few disagree with those statements in principle, but in practice they can be difficult to implement. Developing sustainable solutions is by no means impossible, but it does require real expertise: a good understanding not only of the principles and practices of biosafety as they are understood internationally, but also of the biosafety practices and legislation of the local country, and of the actual work done by the institute in question. It also requires a liberal helping of compromise. “Cookie cutter” approaches that attempt to replicate a particular foreign lab in a former Soviet republic may well be faster to implement, and will require much less expertise and possibly even fewer funds up front. They will also often be easier “sells” to the approval authorities in the donor countries, since duplicating something that exists is generally less controversial than approving something new. But they will not always be sustainable. And note that sustainability is not simply a matter of funding. What is written on a piece of paper can be dictated from abroad, or from senior levels of a local ministry. But what is actually done in the lab by scientists on a day-to-day basis requires consensus. The metric should be not whether a certain practice mirrors that in a particular foreign lab, but whether it is in fact safe and sustainable.

The former Soviet Union is a region with a strong scientific tradition and many institutes that work with pathogens, and where relatively modest levels of funding can go a long way. Its scientists were long denied full citizenship of the international scientific community, first by politics and then by lack of funding. They now very much want greater integration with their peers around the world. They have continued to do science under very trying conditions, and have results and experience that can benefit others. They want to share this, and they also want to learn what the wider world has to teach. Sustainable, effective biosafety and biosecurity solutions developed and implemented there, with the assistance of thoughtfully applied funding and expertise from abroad, will be good for the lab workers and surrounding communities, and strengthen regional and global security. They have the potential to be applicable to other developing countries as well, and perhaps even to the donor countries themselves.

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