

SANDIA REPORT

SAND2008-7892
Unlimited Release
December 2008

International Measures to Improve Laboratory Biosafety and Biosecurity: A Review of Key Events since 2003

International Biological Threat Reduction

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Acronyms and Abbreviations

ABP	African Biosecurity Project
ABSA	American Biological Safety Association
ABSL	Animal Biosafety Level
ACDP	UK Advisory Committee on Dangerous Pathogens
AFENET	African Field Epidemiology Network
AFRO	WHO Africa Regional Office
AG	Australia Group
ANBio	Brazilian Biosafety Association
A-PBA	Asia-Pacific Biosafety Association
APCSS	Asia-Pacific Center for Security Studies
APSED	Asia-Pacific Strategy on Emerging Communicable Diseases
BACAC	Biosafety Association for Central Asia and the Caucasus
BAG	Biosafety Advisory Group
BLBP	Biosafety and Laboratory Biosecurity Program
BRC	Biological Resource Centers
BSL	Biosafety Level
BTWC	Biological and Toxin Weapons Convention
CBRN	Chemical, Biological, Radiological and Nuclear
CDC	US Centers for Disease Control and Prevention
CEN	European Committee for Standardization
COE-DMHA	Center for Excellence in Disaster Management and Humanitarian Assistance
DOE	US Department of Energy
EBSA	European Biosafety Association
ECDC	European Center for Disease Prevention and Control
EMRO	WHO Eastern Mediterranean Regional Office
EU	European Union
EUJA-BTWC	European Union Joint Action in support of the Biological and Toxin Weapons Convention
EuropaBio	European Association for Bio-Industries
FAO	Food and Agriculture Organization of the United Nations
FP6	Sixth Framework Program
G8	Group of 8
GCSP	Geneva Centre for Security Policy
GPP	Global Partnership Program
HSE	UK Health and Safety Executive
IAG	International Advisory Working Group on Biosafety and Biosecurity
IAMP	InterAcademy Medical Panel
IAP	InterAcademy Panel on International Issues
ICCC	International Congress for Culture Collections
ICLS	International Council for the Life Sciences
ICRC	International Committee of the Red Cross
ICSU	International Council for Science
IFP	International Futures Program

IHR	International Health Regulations
Interpol	International Police
ISBER	International Society for Biological and Environmental Repositories
ISIS Europe	International Security Information Service, Europe
ISTC	International Science and Technology Center
IUBS	International Union of Biological Sciences
IUMS	International Union of Microbiological Societies
IWG-LNCV	Network Centro Volta-International Working Group
JFS DG	Justice, Freedom and Security Directorate General
JICA	Japan International Cooperation Agency
LNCV	Landau Network-Centro Volta
NGO	Non-governmental organization
NIH	US National Institutes of Health
NIS	Newly Independent States
NP TEMPO	Russian Non-commercial Partnership, Technology, Education, Marketing, Production and Optimization
OECD	Organization for Economic Cooperation and Development
OIE	World Organization for Animal Health
PAHO	WHO Pan American Health Organization
PGS	Partnership for Global Security
RANSAC	Russian American Nuclear Security Advisory Council
SEARCCT	Southeast Asia Regional Center for Counter-Terrorism
SEARO	WHO Southeast Asia Regional Office
SIPRI	Stockholm International Peace Research Institute
SNL IBTR	Sandia National Laboratories International Biological Threat Reduction
STCU	Science and Technology Center in Ukraine
TACIS	Technical Assistance to the Commonwealth of Independent States
UK	United Kingdom
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDIR	United Nations Institute for Disarmament Research
UNSCR	United Nations Security Council Resolution
US	United States
USAID	US Agency for International Development
USDA	US Department of Agriculture
WFCC	World Federation for Culture Collections
WHA	World Health Assembly
WHO	World Health Organization
WMD	Weapons of Mass Destruction
WPRO	WHO Western Pacific Regional Office

Introduction

In 2006, the Sixth Review Conference of the Biological and Toxin Weapons Convention (BTWC) established an extensive work program for the 2007-2010 intercessional meetings. The intent of these four annual meetings is to “discuss and promote a common understanding and effective action” on six focused areas in preparation for the 2011 Seventh BTWC Review Conference.¹

The 2008 intercessional meeting specifically addressed national, regional, and international measures to improve biosafety and biosecurity, including laboratory safety and security of pathogens and toxins.² Although multiple definitions of these terms are circulated internationally, the World Health Organization (WHO) defines laboratory biosafety as “the containment principles, technologies and practices that are implemented to prevent unintentional exposure to pathogens and toxins, or their accidental release”; laboratory biosecurity is defined as the “institutional and personal security measures designed to prevent the loss, theft, misuse, diversion or intentional release of pathogens and toxins.”³ There have been numerous initiatives and events that have taken place in these areas since the previous intercessional meeting was devoted to these subjects in 2003. Examples include the WHO’s publication of *Biorisk Management: Laboratory Biosecurity Guidance*, the Organization for Economic Cooperation and Development’s (OECD) publication of management practices for biological resource centers (BRCs), and the enactment of several resolutions, such as the World Health Assembly’s (WHA) Resolution 58.29.

The 2008 intercessional meeting highlighted the threat of someone acquiring biological weapon material from a legitimate bioscience laboratory. This concern has received significant attention as advanced laboratory technologies and techniques are emerging at an unprecedented rate in the biomedical and scientific sectors. Today, these technologies are cheaper, simpler, and more accessible than ever before. While the benefit of these technologies is undoubtedly remarkable, they also pose significant risks; many of the tools and techniques utilized in research and diagnostic laboratories are “dual-use” – they can be used for good or harm. Therefore, it is crucial to educate, train, and prepare all scientists and researchers about the inherent dangers present in a bioscience laboratory setting, and to strengthen bio-scientist compliance with national and international laboratory biosafety and biosecurity guidelines.

¹*Report of the Meeting of Experts, Fourth Meeting, Sixth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction*, August 2007, <http://www.opbw.org/>

²“Final Report”, *Sixth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction, BWC/CONF.VI/6*, December 2006, <http://www.opbw.org/>

³World Health Organization, *Laboratory biosafety manual, Third edition*, 2004, http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_CSR_LYO_2004_11/en/index.html

This report provides an overview of important laboratory biosafety and biosecurity events between the 2003 and 2008 intercessional meetings. In addition, it describes the impact of these events towards the goal of improving implementation of laboratory biosafety and biosecurity internationally. The organizations and events highlighted in this paper are only illustrative examples; the global community has been very active in this area, making it nearly impossible to address all international events since 2003. It is also important to note that biosecurity is often considered within the larger context of laboratory biosafety, and that a good laboratory biosafety program addresses most laboratory biosecurity issues. Therefore, laboratory biosecurity is likely a component of many of the biosafety activities discussed in this report, even if it is not explicitly identified.

The report is organized as follows: Part I will describe key activities of major international organizations; Part II will highlight regional events. Six regions are included in the analysis: Africa, Asia, Europe, Latin America, the Middle East, and Russia and the Newly Independent States (NIS). A discussion of internationally or domestically funded activities by the United States (US) Government will be limited in this analysis.

Part I: International Biosafety and Biosecurity Events

The number and scope of international laboratory biosafety and biosecurity events have dramatically increased over the last five years. These efforts have resulted in many conferences, workshops, trainings, publications, as well as identification of new resources and implementation of new legislation. In contrast to previous efforts, many of the measures described below engage a wider, previously inaccessible, international audience. Several key events were hosted by established organizations; other events were coordinated by organizations relatively new to the area of international biosafety and biosecurity.

Food and Agriculture Organization of the United Nations (FAO) and the World Organization for Animal Health (OIE)

The Food and Agriculture Organization (FAO) is a specialized agency of the United Nations (UN) whose primary mission is to defeat hunger internationally.⁴ While the FAO generally defines biosafety and biosecurity in relation to risks associated with agriculture and food quality, it has also developed several resources and programs aimed at enhancing laboratory biosafety and biosecurity as part of its broader mission. Some examples of its activities include surveillance, provision of disease control, laboratory equipment and supplies, public awareness, technical information, laboratory capacity building, as well as education and technical training for laboratory staff. The FAO also created the *Biosafety Resources* website in 2003 which was updated in 2005.⁵ This website primarily discusses biosafety as defined in the Cartagena Protocol on Biosafety. However, there are many online laboratory biosafety resources available including guidelines, manuals, reports, and toolkits, as well as the WHO's *Laboratory Biosafety Manual* (Third Edition).⁶

The World Organization for Animal Health (OIE) is an intergovernmental organization established to promote animal health globally. The OIE is also generally concerned with agricultural biosecurity, but it has published many guidelines for biosafety and biosecurity in laboratory environments. To date, the OIE has published five International Standards⁷: 1) *The Terrestrial Animal Health Code (2007)*⁸ 2) *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals (2004)*⁹ 3) *Aquatic Animal Health Code*

⁴ Food and Agriculture Organization of the United Nations, <http://www.fao.org/>

⁵ Food and Agriculture Organization of the United Nations, *Biosafety Resources*, http://www.fao.org/sd/sdr/biosafety/index_en.asp

⁶ World Health Organization, *Laboratory Biosafety Manual - Third Edition*, 2004 http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_CSR_LYO_2004_11/en/

⁷ World Organization for Animal Health, "Standards", http://www.oie.int/eng/publicat/en_normes.htm?e1d11

⁸ Most relevant section is Chapter 1.4.5: "International transfer and laboratory containment of animal pathogens"; World Organization for Animal Health, *Terrestrial Animal Health Code (2007)*, http://www.oie.int/eng/normes/Mcode/en_sommaire.htm

⁹ World Organization for Animal Health, *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals*, http://www.oie.int/eng/normes/mmanual/A_summry.htm

(2007),¹⁰ 4) *Manual of Diagnostic Tests for Aquatic Animals (2006)*¹¹ and 5) *Quality Standard and Guidelines for Veterinary Laboratories: infectious diseases (2008)*.¹²

The introductory chapters (Chapter I.1.6, including Appendix I.1.6.1) of the *Terrestrial Manual* contain the most relevant information regarding laboratory biosafety and biosecurity. This publication describes risk assessments of various pathogens, the grouping of micro-organisms into four hazard groups, essential requirements for work with known and unknown infectious agents and diagnostic samples (including the necessary containment levels), safety cabinets, pathogen storage, transport of infectious materials, and requirements of laboratory animal facilities.¹³ Similar discussion on animal pathogen risk groups, bio-containment levels, and transfers are described in the Appendix as well as *Terrestrial Animal Health Code*.¹⁴ The *Quality Standards and Guidelines for Veterinary Laboratories: infectious diseases* describes standards for the management, biosecurity, and technical requirements of laboratories that conduct tests for infectious diseases; it also provides details on testing methods validation, reference reagents, and laboratory proficiency testing.^{15, 16} All OIE Standards are available on-line, and are updated annually.

The FAO and the OIE work together on many projects. Since 2003, both organizations have been heavily involved in efforts to contain the spread of H5N1 highly pathogenic avian influenza, especially in Southeast Asia. In 2005, the FAO and the OIE created OFFLU, a network of avian influenza expertise that, among many other roles, establishes links among laboratories in industrialized and developing countries to provide capacity building, education, and training.¹⁷ Both organizations have also collaborated on many publications. Most notably, the OIE and FAO collaborated with the WHO on *Biorisk management: Laboratory biosecurity guidance* in 2006.¹⁸

¹⁰ World Organization for Animal Health, *Aquatic Animal Health Code (2007)*, http://www.oie.int/eng/normes/fcode/A_summry.htm

¹¹ World Organization for Animal Health, *Manual of Diagnostic Tests for Aquatic Animals (2006)*, http://www.oie.int/eng/normes/fmanual/A_summry.htm

¹² World Organization for Animal Health, *Quality Standards and Guidelines for Veterinary Laboratories: infectious diseases (2008)*, http://www.oie.int/eng/publicat/ouvrages/A_112.htm

¹³ World Organization for Animal Health, *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals*, http://www.oie.int/eng/normes/mmanual/A_00016.htm

¹⁴ World Organization for Animal Health, *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals*, http://www.oie.int/eng/normes/mmanual/A_00017.htm

¹⁵ World Organization for Animal Health, *OIE Quality Standard and Guidelines for Veterinary Laboratories: infectious diseases*, http://www.oie.int/eng/publicat/ouvrages/A_112.htm

¹⁶ Pinto, J and Lubroth, J at the Meeting of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (biological) and Toxin Weapons and on Their Destruction, Meeting of Experts, 'The Challenge of International Biosecurity: the OIE Standards and FAO-OIE activities', 19-30 July 2004.

¹⁷ OFFLU, <http://www.offlu.net/>

¹⁸ World Health Organization, *Biorisk management: Laboratory biosecurity guidance 2006*, http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6/en/index.html

The InterAcademy Panel on International Issues (IAP)

The InterAcademy Panel on International Issues (IAP) is a global network of science academies. In 2004, the IAP Executive Council appointed a working group on biosecurity, whose primary purpose was to inform member academies about the potential impact of biosciences research on global society, and the risks associated with the misuse of such research.

Since 2003, the IAP has convened several key conferences promoting biosecurity, including two international forums. In March 2005, the IAP, in partnership with the International Council for Science (ICSU), the InterAcademy Medical Panel (IAMP), and the US National Academies, hosted the International Forum on Biosecurity in Como, Italy.¹⁹ Fifty two participants from 19 countries and four international organizations attended. The second international forum in biosecurity was held in Budapest, Hungary in March 2008. Most discussions addressed developing scientific codes of conduct and advancing awareness about the challenges posed by the “dual-use dilemma”. Other conference presentations articulated the need for 1) an international system to control the access of dangerous pathogens within and between laboratories 2) a common international understanding of biosafety and biosecurity terminology, and 3) international biosafety and biosecurity regulations similarly to the United States.²⁰

On 1 December 2005, the IAP working group released the *IAP Statement on Biosecurity*, signed by 68 national academies of science.²¹ The purpose of this document was to present fundamental guidelines, or codes of conduct, that the scientific community should consider when conducting dual-use research. The statement addresses five major principles: Awareness, Safety and Security, Education and Information, Accountability, and Oversight. This statement was later presented to the United Nations Meeting of Experts of the Biological Weapons Convention in Geneva on 5-9 December 2007.

International Committee of the Red Cross (ICRC)

In 2002, the International Committee of the Red Cross (ICRC) developed the Biotechnology, Weapons, and Humanity initiative in recognition of the potential for biological agents to be misused by either states or non-state actors to inflict harm.²² This initiative was a direct appeal to governments, the scientific community, the military, and industry to recognize the risks inherent in life sciences and biotechnology.

¹⁹ The National Academies, “International Forum on Biosecurity, 2005”, http://www7.nationalacademies.org/biso/Biosecurity_Forum.html

²⁰ The National Academies, “International Forum on Biosecurity, 2005”, http://www7.nationalacademies.org/biso/Biosecurity_Forum.html

²¹ InterAcademyPanel on International Issues, *IAP Statement on Biosecurity*, November 2005, <http://royalsociety.org/displaypagedoc.asp?id=17463>

²² International Committee of the Red Cross, “Biotechnology, Weapons and Humanity”, <http://www.icrc.org/web/eng/siteeng0.nsf/htmlall/bwh?opendocument>

In 2004, the ICRC developed and published "Principles of Practice," which were part of a larger document, *Preventing Hostile Use of the Life Sciences: From Ethics and Law to Best Practice*.²³ A total of 11 Principles are described with recommended action points. Their purpose is to encourage the life sciences community to incorporate ethics and laws into their best practices. Specifically, this document provides a framework for discussion on research, publication, and contracts of employment for scientists, health and safety procedures, professional practice, and educational programs.

Since 2004, the ICRC has promoted the objectives of the initiative by engaging the international scientific and health-care communities in various ways. The ICRC has presented its concerns and proposals at dozens of meetings and round-tables with scientific associations and academies (for a list of key meetings, see Appendix I). The ICRC has also endorsed a variety of measures, including adopting professional and industrial codes of conduct and ensuring effective regulation of research.

International Union of Microbiological Societies (IUMS)

The primary objective of the International Union of Microbiological Societies (IUMS), a union within the ICSU, is to promote research and the exchange of scientific information for the advancement of human health and welfare.²⁴ Currently, the IUMS has 113 member societies and 114 associate members in over 100 countries. The IUMS actively promotes biosecurity and biosafety research and training.

In April 2006, IUMS developed the *Code of Ethics against the Misuse of Scientific Knowledge, Research, and Resources*.²⁵ IUMS recommends that its member societies adopt or develop a similar code of ethics to prevent the misuse of scientific knowledge and resources. In this document, the IUMS addresses the need to 1) develop educational programs in the area of biosecurity and biosafety for member societies, and 2) apply a self-regulatory approach to balancing scientific freedom and biosecurity.²⁶

Interpol

Interpol is the world's largest international police organization, which currently consists of 186 member countries. Interpol's primary purpose is to prevent international crime. In 2004, Interpol established its Bioterrorism Prevention Program to address this global challenge.

Interpol has hosted a number of international bioterrorism conferences since its first and largest meeting, the 1st Interpol Global Conference on Preventing Bioterrorism, in March

²³ International Committee of the Red Cross, *Preventing Hostile Use of the Life Sciences: From Ethics and Law to Best Practice*, <http://www.icrc.org/Web/Eng/siteeng0.nsf/htmlall/bwh?OpenDocument>

²⁴ International Union of Microbiological Societies, <http://www.iums.org/index.html>

²⁵ International Union of Microbiological Societies, *IUMS Code of Ethics against Misuse of Scientific Knowledge, Research and Resources*, 2006. http://www.iums.org/about/about_us-Codeethics.html

²⁶ International Union of Microbiological Societies, *IUMS Code of Ethics against Misuse of Scientific Knowledge, Research and Resources*, 2006. http://www.iums.org/about/about_us-Codeethics.html

2005. In response to the needs of this seminal conference, Interpol conducted a series of events, known as the Interpol Workshops on Preventing Bioterrorism. These meetings were aimed at educating senior law enforcement officials in several areas, including biohazards, laboratory security, and bioterrorism identification. In 2005-2007, Interpol conducted these workshops: Cape Town, South Africa (November 2005); Singapore (March 2006); Santiago, Chile (July 2006); Kiev, Ukraine (November 2006); and Muscat, Oman (March 2007).²⁷

The *Bioterrorism Incident Pre-Planning and Response Guide*, published in 2007, is a comprehensive manual for law enforcement in preparing for and responding to a bio-incident.²⁸ Part I of the manual describes the bioterrorism threat, and provides background information concerning the BTWC. It describes biological agents, their characteristics, and how they can be acquired, produced, and disseminated. Specifically, the “Biological Agent Acquisition” section provides several examples of biological acquisition pathways, including theft from culture collections, universities, microbiological laboratories, veterinary laboratories, and industry. The Guide also explains that an adversary may steal an agent by evading laboratory biosecurity practices, including co-opting legitimate employees. The Guide was compiled by experts from Interpol member countries, and is available in all four of the organization’s official languages, Arabic, English, French, and Spanish.²⁹

Interpol also established the *Bioterrorism Prevention Resource Center* in 2006.³⁰ This website was created to act as a central resource for a variety of bioterrorism-related information, and was intended to promote awareness among member countries, public health officials, customs and law enforcement, and international organizations. Specific links on the website relating to various aspects of laboratory biosafety and biosecurity include Building and School Safety, Biocontainment Laboratories, Decontamination, and Personal Protective Equipment.³¹

Organization of Economic Co-operation and Development (OECD)

The Organization for Economic Cooperation and Development (OECD), a group of 30 market democracies that works “to address the economic, social, and governance challenges of the globalizing world economy,”³² began its biosecurity program in September 2004. Since this time, the OECD has become a key international player in addressing the concerns of bioterrorism risk. The OECD has been responsible for hosting

²⁷ Interpol, “Bioterrorism workshops, conferences and events”, <http://www.interpol.int/Public/BioTerrorism/Workshops/Default.asp>

²⁸ Interpol, *Bioterrorism Incident Pre-Planning & Response Guide*, <http://www.interpol.int/Public/BioTerrorism/BioterrorismGuide.pdf>

²⁹ Ibid.

³⁰ Interpol, *Bioterrorism Prevention Resource Center*, <http://www.interpol.int/Public/BioTerrorism/links/default.asp>

³¹ Interpol, *Bioterrorism Prevention Resource Center*, <http://www.interpol.int/Public/BioTerrorism/links/default.asp>

³² The Organization of Economic Co-operation and Development, <http://www.oecd.org/>

several conferences, publishing influential documents, and creating an informative biosecurity online resource.

Since 2001, the OECD has been facilitating the establishment of a global network for biological resource centers (BRCs), or “facilities that house, control, test or use biological materials” with harmonized national standards and regulations to ensure availability of rare biological resources and permit free exchange of microbial cultures.³³ In February 2007, *OECD Best Practice Guidelines for Biological Resource Centers*³⁴ was presented to the Working Party’s 21st session. In general, this report presents a series of best practices or guidance for the management of BRCs. This document states that all participants must adhere to a system that ensures biological quality and security; benefits of the network can only be accessed by meeting these requirements for membership.³⁵ The report consists of two main parts: Part I provides the background, rationale for the project, and the methodology used to develop the guidelines. Part II consists of four agreed upon sets of best practices for BRCs:

- *General Best Practice Guidelines for all BRCs*
- *Best Practice Guidelines on Biosecurity for BRCs*
- *Best Practice Guidelines for the Micro-organism Domain*
- *Best Practice Guidelines for the Human-Derived Material*

The aim of the “Best Practice Guidelines on Biosecurity for BRCs”³⁶ is to reduce the risk that dangerous biological material could be obtained by unauthorized persons and used maliciously. This report is designed to secure all types of bio-material in proportion to the risk they present. This guideline adopts an approach consisting of two key components: 1) performing a risk assessment of the various biological materials held in collections which assigns materials to one of four biosecurity risk levels: high, moderate, low or negligible, according to the degree of risk the biological material presents, and 2) recommended risk management practices to reduce the risk of loss or theft.³⁷

On 17-19 September 2004, the International Futures Program (IFP) of the OECD convened a high-level meeting in Frascati, Italy entitled Promoting Responsible Stewardship in the Biosciences: Avoiding Potential Abuse of Research and Resources. For three days, 55 international representatives selected from government, academia, industry, public research organizations, and scientific representatives discussed measures that would foster a balance between the promotion of scientific freedom and biosecurity concerns. This conference generated several key conclusions. First, there was a

³³ Arms Control Today, “Preventing the Misuse of Pathogens: The Need for Global Biosecurity Standards”, June 2003, http://www.armscontrol.org/act/2003_06/tucker_june03.asp

³⁴ *OECD Best Practice Guidelines for Biological Resource Centers*, <http://www.oecd.org/dataoecd/7/13/38777417.pdf>

³⁵ *OECD Best Practice Guidelines for Biological Resource Centers*, <http://www.oecd.org/dataoecd/7/13/38777417.pdf>

³⁶ “The “Best Practice Guidelines on Biosecurity for BRCs”, <http://www.oecd.org/dataoecd/6/27/38778261.pdf>

³⁷ The “Best Practice Guidelines on Biosecurity for BRCs”, <http://www.oecd.org/dataoecd/6/27/38778261.pdf>

consensus amongst participants for the establishment of a common international understanding of key terminology, particularly in regard to the various interpretations of and uses of the terms ‘biosafety’ and ‘biosecurity’. Secondly, participants expressed the need to increase awareness of issues pertaining to biosafety and biosecurity among researchers and to develop “codes of practice, for accreditation of facilities and for registration of personnel.”³⁸ Participants additionally expressed a desire for a transparent and comprehensive information resource to capture and consolidate the information generated between the life sciences and the security communities that would provide access to details of legislation in force.³⁹

On 20-21 September 2006, the OECD and the Russian Federation held a joint workshop in Moscow entitled “Biosecurity of Microbial Biological Resources – Complementing Innovation.” Eighty-five representatives from 15 countries met to discuss the policy challenge of securing dangerous pathogens without compromising the potential benefits of biomedical research for society. Participants included stakeholders from twelve various governments, the WHO, several biotechnology industry associations, academic institutions, public research organizations, and civil society. Participants generally agreed that pathogen security would require multidisciplinary and international expertise from both the scientific and security communities. It was also agreed that pathogen security should be integrated with biosafety in a practical manner. Harmonization within biosecurity was also considered important, including agreement on common terminology, development of risk assessment methodologies for pathogens, and scientific networks to exchange information on the hazard of particular pathogens. Lastly, participants agreed international organizations should continue to promote biosafety and biosecurity in laboratories.⁴⁰

Finally, OECD’s IFP launched www.biosecuritycodes.com in response to the recommendations proposed in the 2004 Frascati meeting. This website is dedicated to providing a resource of online biosecurity, biotechnology, and biosafety information. Its purpose is to advance awareness of global efforts in these areas and promote responsible oversight of the biosciences in the scientific community. The site lists key biosecurity players with links to international, national, government, academia, industry, and non-profit institutions. The website also offers a list of future and past events, meetings, and conferences. Other information includes background materials such as reports, press releases, and presentations, a glossary, laws and regulations, including legislation implementing the BTWC, and non-binding codes of conduct written by national science foundations and academies regarding the responsibility of scientists to act ethically with the biological materials entrusted to them.⁴¹

³⁸ “Promoting Responsible Stewardship in the Biosciences: Avoiding Potential Abuse of Research and Resources”, Chairman’s Summary September 2004, www.oecd.org/dataoecd/30/56/33855561.pdf

³⁹ Ibid.

⁴⁰ “Biosecurity of Microbial Biological Resources – Complementing Innovation”, Chairman’s Summary September 2006, www.oecd.org/dataoecd/24/14/37819508.pdf

⁴¹ www.biosecuritycodes.org

United Nations Security Council Resolution 1540

On 28 April 2004, the United Nations Security Council unanimously passed resolution 1540 (UNSCR 1540) which affirmed that “proliferation of nuclear, chemical and biological weapons, as well as their means of delivery, constitutes a threat to international peace and security.”⁴² UNSCR 1540 calls on all states to fulfill three primary directives:

1. Refrain “from providing any form of support to non-State actors that attempt to develop, acquire, manufacture, possess, transport, transfer or use nuclear, chemical or biological weapons and their means of delivery.”⁴³
2. Create and enforce national laws prohibiting any non-state actor from developing, acquiring, manufacturing, possessing, transporting, transferring, or using such weapons and their means of delivery.
3. Establish and enforce domestic control measures to prevent the proliferation of such weapons. Four control measures are specifically cited in the Resolution:
 - a. Measures to “account for and secure such items in production, use, storage, and transport”⁴⁴
 - b. Physical protection measures
 - c. Border controls and other law enforcement efforts to “detect, deter, prevent and combat...trafficking of such items”⁴⁵
 - d. Export and end-user controls

The Resolution also established a Committee, with an initial mandate of two years, to oversee the implementation of UNSCR 1540. All states were required to report to the Committee within six months of the adoption of the Resolution. Additionally, UNSCR 1540 encourages states to provide national control lists, and calls on member states to provide others with assistance in implementing the Resolution when needed and possible. Based on recommendations presented in the final report of the Committee on 25 April 2006, the Security Council extended the Committee’s mandate for two additional years with UNSCR 1673.⁴⁶ The Committee has also developed an online database to provide additional information on the national implementation of regulation and measures related to the resolution.⁴⁷

World Federation for Culture Collections (WFCC)

The World Federation for Culture Collections (WFCC) is a Federation of the IUMS and a commission of the International Union of Biological Sciences (IUBS). The purpose of

⁴² United Nations Security Council Resolution 1540, http://www.un.org/Docs/sc/unsc_resolutions04.html

⁴³ United Nations Security Council Resolution 1540, http://www.un.org/Docs/sc/unsc_resolutions04.html

⁴⁴ Ibid.

⁴⁵ Ibid.

⁴⁶ United Nations Security Council, *Letter dated 2006/04/25 from the Chairman of the Security Council Committee established pursuant to resolution 1540 (2004) addressed to the President of the Security Council*, S/2006/257, 2006.

⁴⁷ United Nations Security Council Resolution 1540 (2004), “Legislative Database”, <http://www.un.org/sc/1540/legisdatabase.shtml>

the WFCC is to promote and support the establishment of international culture collections and related services.

Since 2004, the WFCC has taken a number of measures to address the topics of biosafety and biosecurity. The WFCC routinely collaborates with several international organizations such as the OECD, the UN, and the WHO to ensure best practices are adopted by culture collections. The WFCC website also has links to European and US biosecurity practices.⁴⁸ The OECD Biological Resource Center Guidelines are also available on the website.⁴⁹ The WFCC advocates member culture collections becoming BRCs so they can operate according to international quality criteria, conduct essential research, enhance the value and applications of strains, and provide a vital information resource.

Since 2003, the WFCC has hosted two major conferences that discussed biosafety and biosecurity. In October 2004, the WFCC and the Japan Society for Culture Collections jointly organized the 10th International Congress for Culture Collections (ICCC-10) in Tsukuba, Japan. The meeting brought together a total of 479 participants from 40 countries and two international organizations, United Nations Educational, Scientific and Cultural Organization (UNESCO) and OECD.⁵⁰ The second conference, the 11th International Culture Collection Conference (ICCC-11), took place in October 2007 in Goslar, Germany. Participants from 47 countries attended.⁵¹ At this meeting, biosafety and biosecurity was one of nineteen topics discussed. In addition to biosecurity presentations, hard copies of the *OECD Best Practice Guidelines for Biological Resource Centers* were distributed.⁵² The WFCC also co-hosted a training workshop in Rabat, Morocco in May 2004 entitled Management of Culture Collections of Microorganisms. The aim of this course was to train local and regional microbiologists on all aspects of organization, management, and operation of culture collections. Biosafety was one of 17 topics discussed.⁵³

In addition, the Executive Board established nine Work Programs to prioritize the work of the WFCC at the 2004 ICCC-10 meeting. Two of the programs relate specifically to biosafety and biosecurity: Postal, Quarantine, and Biosafety Regulations Work Program and Quality Matters Work Program.⁵⁴ A core function of the first program is to advise WFCC member collections on best practice, how to establish courses, workshops and individual training, and how to address questions in areas of biosecurity, biosafety, transport, and compliance with legislation. This group is specifically focused on international harmonization of biological agent Risk Groups, information dissemination and educational outreach, inclusion of new species in the Risk Groups, developing

⁴⁸ World Federation of Culture Collections, <http://www.wfcc.info/newsletter.html>

⁴⁹ WFCC website, Available at: <http://www.wfcc.info/whatnew.html>

⁵⁰ ICCC-10 scored a great success, WFCC website. Available at: <http://www.wfcc.info/new/ICCC10/ICCC-10.html>

⁵¹ ICCC-11 2007, WFCC website. Available at: http://www.iccc11.de/index.php?contentleft_id=17

⁵² ICCC-11 2007, WFCC website. Available at: <http://www.iccc11.de/>

⁵³ WFCC website, Available at: <http://www.wfcc.info/tcrb.html>

⁵⁴ WFCC Newsletter, No. 40 2005. WFCC website, Available at: <http://www.wdcm.org/wfcc/NEWSLETTER/news40/p38.pdf>

biosecurity codes of conduct, and transport lists of biological agents. The Quality Matters Work Program works primarily with the OECD BRC Task Force and the International Society for Biological and Environmental Repositories (ISBER) to develop appropriate operational biosecurity standards for culture collections.⁵⁵

World Health Organization (WHO)

The World Health Organization (WHO) has been a world leader in engaging the international community on biosafety and biosecurity issues, primarily through its Biorisk Reduction Program (which houses the Biosafety and Laboratory Biosecurity Program). The WHO also works to strengthen capacities, including training, in developing countries for the early detection, rapid verification, and response to outbreaks of infectious disease, including preparedness for accidental or deliberate releases. The WHO closely works with the FAO and OIE concerning animal disease surveillance and response.

Since 2003, the WHO has published a number of benchmark guides, manuals, and other documents relevant to biosafety and biosecurity. Most notably, in 2004, the WHO released its third edition of the *Laboratory Biosafety Manual*. This influential document provides practical guidance on biosafety for all types of laboratories and levels. Part I describes microbiological risk assessment, containment principles for biosafety level (BSL) 1-4 and animal biosafety level (ABSL) 1-4, and guidelines for the commissioning and certification of laboratories. Part II explains laboratory biosecurity concepts. Although just two pages in length, this section is pivotal, marking the first time “laboratory biosecurity” was included. Part III describes laboratory safety equipment; Part IV advocates proper laboratory technique, and discusses the latest regulations for the transport of infectious material. Parts V-VII describe the safe use of recombinant DNA technology; chemical, fire and electrical safety aspects; safety organization and training programs.⁵⁶ This document is translated into ten different languages, and is available online. Later, the WHO elaborated on laboratory biosecurity concepts with the 2006 publication of *Biorisk management: Laboratory Biosecurity Guidance*. This document describes the protection, control, and accountability for valuable biological materials within laboratories, in order to prevent their unauthorized access, loss, theft, misuse, diversion or intentional release.⁵⁷ Furthermore, the *Guidance on Regulations for the Transport of Infectious Substances* was revised and expanded in 2007.⁵⁸

Resolution 58.29

In 2005, Resolution 58.29 of the 58th World Health Assembly (WHA) urged member states of the WHO to take a number of steps to enhance laboratory biosafety and contain

⁵⁵ WFCC Newsletter, No. 40 2005. WFCC website, Available at: <http://www.wdcm.org/wfcc/NEWSLETTER/news40/p38.pdf>

⁵⁶ World Health Organization, *Laboratory Biosafety Manual - Third Edition*, 2004 http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_CSR_LYO_2004_11/en/

⁵⁷ World Health Organization, *Biorisk management: Laboratory biosecurity guidance*, 2006, http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2006_6/en/index.html

⁵⁸ World Health Organization, *Guidance on regulations for the Transport of Infectious Substances*, http://www.who.int/csr/resources/publications/biosafety/WHO_CDS_EPR_2007_2cc.pdf

biological agents.⁵⁹ Member states were advised to review protocols for ensuring safe handling of harmful biological agents. States were also instructed to establish biosafety practices in accordance with WHO guidance. Mobilization of national and financial resources sufficient to accomplish these goals, as well as the requisite international support and cooperation, were also recognized as important components.

Biosafety and Laboratory Biosecurity (Biorisk reduction)

The WHO's Biosafety and Laboratory Biosecurity Program (BLBP) pursues a variety of activities in collaboration with the WHO's six regional offices, national governments, and organizations, as well as their international Biosafety Advisory Group (BAG).⁶⁰ The program's work consists of assisting member states with improving laboratory biorisk management through the implementation of WHA's Resolution 58.29.

BLBP has held five awareness-raising workshops in different regions of the world between 2005 and 2007 (See Appendix IA).⁶¹ BLBP is developing a number of training tools and guidelines to help states comply with WHA 58.29 including four training tools: a biosafety train-the-trainers manual based on the 3rd edition of the Laboratory Biosafety Manual, a laboratory risk assessment guidelines document, a training DVD for the transport of infectious substances, and a training DVD on the appropriate use of biosafety cabinets. The BLBP also participated in the European Committee for Standardization's (CEN) initiative to create standards for managing laboratory biorisks (security and safety). Finally, the program provides technical assistance in implementation of International Health Regulations (IHR) relevant to biosafety and biosecurity issues.⁶²

⁵⁹ World Health Organization, "Fifty-eighth World Health Assembly", <http://www.who.int/mediacentre/events/2005/wha58/en/index.html>

⁶⁰ World Health Organization, "Biosafety and laboratory biosecurity" <http://www.who.int/csr/bioriskreduction/biosafety/en/index.html>

⁶¹ World Health Organization, "Biosafety and laboratory biosecurity", http://www.who.int/csr/bioriskreduction/biosafety/global_awareness/en/index.html

⁶² World Health Organization, "Biosafety and laboratory biosecurity", http://www.who.int/csr/bioriskreduction/biosafety/key_activities/en/index.html

Part II: Regional Biosafety and Biosecurity Events

Regional activity in laboratory biosafety and biosecurity varies significantly in different areas of the world. Overall, Europe, Latin America, and some advanced areas of Asia demonstrate a growing laboratory biosafety and biosecurity capacity. These areas are heavily targeted by conferences, regional biosafety associations, institutional courses, and websites. In contrast, biosafety and biosecurity are new concepts in most of Africa and the Middle East, two undeveloped regions that have received the least amount of international attention.

Africa

In most of Africa, biosafety and biosecurity is given a low priority compared to other pressing issues, such as failing public health systems. However in 2005, African countries began to realize that efforts to enhance biosafety and biosecurity could support efforts to strengthen the public health infrastructure, thereby increasing capacity to combat a variety of endemic infectious diseases.

One of the first key African meetings discussing bioterrorism and laboratory biosecurity issues in sub-Saharan Africa was held in Kampala, Uganda in October 2005. African leaders discussed and recognized the need for basic laboratory facility governance for both healthcare and the prevention of bioterrorism, but further stated that it would be “illegitimate to address threats of biological weapons without addressing other [public health] crises.”⁶³ Therefore, in an attempt to promote human health and security in Africa, the meeting developed the “Global Bargain for Biosecurity and Health” initiative. This initiative proposed African states would make certain commitments—including enhancing biosecurity—in exchange for assistance in a number of areas, such as public health infrastructure and capacities, vaccines and preventative treatment programs, disease monitoring, surveillance systems, and academic support. The participants of this meeting issued the *Kampala Compact*, which declared representative African States would adopt and implement a number of biosafety and biosecurity measures including laboratory, pathogen, and transport safety and security; encourage preparation and response capabilities; enact legislation for criminalization of illicit biological pursuits; and develop ethical codes of conduct for scientists.⁶⁴

As a follow-up to the Kampala Compact, legal experts from twelve sub-Saharan countries formed the African Biosecurity Project (ABP) in 2006, whose primary purpose is to analyze African legal systems and their readiness to prevent bio-violence. In July 2007, ABP members convened in Nairobi to discuss results of their work in these areas. During the meeting, delegates discussed the structural problems concerning the implementation of national biosecurity legislation. Results of this workshop generated

⁶³ International Council for Science-Africa, *Kampala Compact: The Global Bargain for Biosecurity and Bioscience*, October, 2005, www.icsu-africa.org/Resource_centre/KampalaCompactoct05.pdf

⁶⁴ Ibid.

the *Nairobi Announcement*, which highlighted the importance of biosecurity issues, and outlined six proposals that would advance biosecurity and enhance legislation.⁶⁵

The WHO Africa Regional Office (AFRO) has been one of the most active organizations in Africa, holding several inter-country trainings throughout various regions. Many of these trainings focus on laboratory techniques and biosafety. One of its major meetings to date, the “Sub-Regional Biosafety and Laboratory Biosecurity Awareness-Raising Meeting”, took place in Nairobi, Kenya in May 2007.⁶⁶ The meeting brought together representatives from national public health and veterinary laboratories throughout Africa. Specifically, WHO experts provided training on the principles of laboratory biosafety and biosecurity for the safe handling, storage, and transport of biological materials, particularly highly pathogenic avian influenza and other infectious diseases.⁶⁷ Twenty-one countries in Africa were invited to the meeting.

In 2005, the African Field Epidemiology Network (AFENET) was created in partnership with the African Ministries of Health, various non-governmental and international agencies, and the private sector. Its primary purpose is to strengthen applied field epidemiology and laboratory capacity in Africa. It is funded by the US Centers for Disease Control and Prevention (CDC) and the US Agency for International Development (USAID).⁶⁸ Their website offers a variety of training materials, including the *AFENET Laboratory Training Course: Curriculum Handbook* and the *Laboratory Investigations Training Manual*.⁶⁹ These handbooks are used to equip middle-level laboratory technicians with skills in laboratory management and disease surveillance through a competency-based short course. In addition to many other topics, the book focuses on laboratory biosafety and extensively discusses a number of safety precautions, the various types of bio-hazards one may be exposed to in the laboratory, and the various means of preventing and managing laboratory accidents.⁷⁰

The European Union Joint Action in support of the Biological and Toxin Weapons Convention (EUJA-BTWC) has held two regional seminars in Africa. The first regional meeting was held in Nairobi in June 2006.⁷¹ Representatives from 10 African countries, including Burundi, Comoros, Djibouti, Madagascar, Malawi, Mozambique, Namibia, Zambia, Kenya, and Uganda attended. The second meeting, the West and Central Africa seminar, was held in Dakar, Senegal in April 2007. Representatives from Angola, Central African Republic, Chad, Côte d’Ivoire, Eritrea, Gabon, Guinea, Liberia, Democratic Republic of Congo, Equatorial Guinea, Gambia, Nigeria, Senegal, Sierra

⁶⁵ *Nairobi Announcement*, July 2007,

www.law.depaul.edu/centers_institutes/iwcc/pdf/nairobi_announcement.pdf

⁶⁶ This meeting was co-funded by the US Department of State’s Biosecurity Engagement Program (BEP)

⁶⁷ US Department of State Biosecurity Engagement Program, “BEP Supports WHO Workshop on Laboratory Biosafety & Biosecurity in Africa”, <http://www.bepstate.net/news.php?id=4>

⁶⁸ AFENET, “Funders and Partners”, <http://www.afenet.net/english/funding.html>

⁶⁹ AFENET, “Training Materials”, <http://www.afenet.net/english/training.html>

⁷⁰ *Ibid.*

⁷¹ EU Joint Action in Support of the Biological and Toxin Weapons Convention, “Report of the regional seminar for Southern and East Africa”, <http://www.euja-btwc.eu/node/64>

Leone, and Togo attended.⁷² Participants from several international organizations and EU Member States also attended. In both meetings, speakers described the importance of biosafety and biosecurity, and its impact on public health. Specific topics focused on raising awareness in the scientific community regarding dual-use issues; monitoring and controlling the possession, transfer, and shipping of pathogens; categorizing biological agents into different risk groups; and developing lists of high risk agents used in the region. Many countries expressed interest in EU assistance in establishing biosecurity and biosafety measures, enhancing laboratory capacity, and building capacity to implement the BTWC. Others asked for the establishment of a coordinated system to oversee and review biotechnology and biosafety activities in Africa.⁷³

Asia

In the last decade, Asia has been at the forefront of several emerging infectious diseases, such as H5N1 avian influenza and severe acute respiratory syndrome. This vulnerability has enhanced the regional awareness of laboratory biosafety and biosecurity.

The WHO Western Pacific Regional Office (WPRO) and the WHO Southeast Asia Regional Office (SEARO) jointly developed the *Asia-Pacific Strategy on Emerging Communicable Diseases* (APSED) in 2005 to provide Asian countries with strategic directions for preparedness, prevention, detection and response to these emerging diseases.⁷⁴ Specifically, the document advocates that each country produce a comprehensive inventory of national resources of existing capacity, including the identification of laboratories able to support public health activities in the public and private sectors, developing appropriate legislation for the regulation and accreditation of laboratories, enhancing training for laboratory staff and management (including safe transport of biological materials and the management of biosafety incidents), upgrading safety laboratory infrastructure, and forming partnerships with laboratories that can provide quality assurance functions, training, and technical support during emergencies.⁷⁵ In April 2005, SEARO and WPRO co-hosted a regional workshop, Global Awareness-Raising for Biosafety and Laboratory Biosecurity, in Singapore.⁷⁶

During the same time, the Asia-Pacific Biosafety Association (A-PBA) was created to facilitate and promote the sharing of biosafety information throughout the region. The association currently represents over 300 practicing biosafety professionals across the

⁷² EU Joint Action in Support of the Biological and Toxin Weapons Convention, “Report of the regional seminar for West and Central Africa”, <http://www.euja-btwc.eu/node/221>

⁷³ EU Joint Action in Support of the Biological and Toxin Weapons Convention, “Report of the regional seminar for West and Central Africa”, <http://www.euja-btwc.eu/node/221>

⁷⁴ World Health Organization Western Pacific Regional Office, *Asia-Pacific Strategy on Emerging Communicable Diseases*, www.wpro.who.int/nr/rdonlyres/fceebb9d-21bb-4a16-8530-756f99efdb67/0/asia_pacific.pdf

⁷⁵ World Health Organization Western Pacific Regional Office, *Asia-Pacific Strategy on Emerging Communicable Diseases*, www.wpro.who.int/nr/rdonlyres/fceebb9d-21bb-4a16-8530-756f99efdb67/0/asia_pacific.pdf

⁷⁶ World Health Organization, “Biosafety and Laboratory Biosecurity”, http://www.who.int/csr/bioriskreduction/biosafety/global_awareness/en/index.html

Asia-Pacific region from such countries as Australia, Brunei Darussalam, Cambodia, China, Hong Kong, India, Indonesia, Japan, Malaysia, Thailand, Philippines, and Myanmar. The A-PBA is also responsible for establishing several country working groups.⁷⁷ As of March 2008, A-PBA has organized a total of four biosafety training courses, six pre-conference workshops, and three scientific conferences.⁷⁸

In addition to meetings and workshops previously mentioned, there have been several major conferences in Asia that address laboratory biosafety and biosecurity. An International Conference on Biosafety and Biosecurity Asia 2007 was held as a joint initiative of eleven agencies and key departments of the Malaysian Government, and Protemp Conferences Sdn Bhd.⁷⁹ The two-day conference mainly focused on the current status of biosafety, emerging needs, biosecurity, immediate challenges and proven threats, life sciences and bioterrorism, and approaches in biosafety and biosecurity management. More than 400 delegates from various countries and international organizations worldwide participated in the conference.⁸⁰

Another major conference, the Asia Conference on Laboratory Biosafety and Biosecurity, held in April 2007, was co-sponsored by Sandia National Laboratories' International Biological Threat Reduction (SNL IBTR) and the Thai National Institute of Animal Health. Keynote speakers from the Philippines, Thailand, Indonesia, Canada, and the WHO provided informative presentations on biological risk assessments, controlling avian influenza, laboratory design, and the WHO laboratory biorisk management program. Participants were from a broad array of organizations including national laboratories, universities, private companies, and government ministries.⁸¹

Between 2005 and 2007, the Southeast Asia Regional Center for Counter-Terrorism (SEARCCT), an organization that focuses on regional training, information sharing, and public awareness campaigns, and the Japan International Cooperation Agency (JICA), Japan's primary governmental agency responsible for the coordination of technical development assistance, held two courses in Kuala Lumpur, Malaysia. The first Training Course on the Prevention and Crisis Management of Biological Terrorism was held in July 2005. There were approximately 73 participants from Brunei Darussalam, Cambodia, Canada, China, France, Indonesia, Japan, South Korea, Laos, Myanmar, Philippines, Singapore, the United States, Vietnam, WHO, and Malaysia. Experts discussed past experiences in bioterrorism, biosecurity, infectious diseases and surveillance, preparedness and response. This meeting also discussed physical security measures, scientific codes of conduct, the establishment of BRCs, WHO guidance, and legislative measures for registering and reporting pathogens. The second meeting, the Prevention and Crisis Management of Chemical and Biological Terrorism, was held in July 2007. The course objectives were to acquire and share knowledge on planning,

⁷⁷ Asia-Pacific Biosafety Association, <http://www.a-pba.org/>

⁷⁸ Ibid.

⁷⁹ Subhash Janardhan B, "Biosafety and Biosecurity in Asia, Meeting Report", 2007, *Current Science*, Vol 93, No 3. Pg 285-6

⁸⁰ Ibid.

⁸¹ Asia Conference on Laboratory Biosafety and Biosecurity, <http://www.asiabiosafetyandsecurity.org/>

development and the coordination of comprehensive policies on counter-terrorism measures that focus on chemical and biological terrorism. In attendance at this conference were officials and experts from Australia, Brunei Darussalam, Cambodia, China, Indonesia, Japan, Korea, Laos, Malaysia, Thailand, the Philippines, Vietnam, the United States, and the WHO (from the Malaysia office). A variety of topics were discussed including efforts to mitigate bioterrorist threats through enhancing laboratory biosafety and biosecurity.

In March 2006, the Australian Department of Defense and the Indonesian Department of Foreign Affairs co-hosted the Second Biological Weapons Convention Regional Workshop in Bali, Indonesia. The purpose of the meeting was to promote regional awareness of and engagement in the BTWC, promote biosecurity, examine national mechanisms for maintenance of the security and oversight of pathogenic micro-organisms and toxins, establish a networking forum to enhance biosecurity and biosafety, and share information. Participants were from Indonesia, Australia, Cambodia, the Lao People's Democratic Republic, Malaysia, New Zealand, Papua New Guinea, the Philippines, Thailand, and Vietnam.⁸² The first Regional Workshop was held in Melbourne, Australia in 2005. This meeting discussed the growing threat posed by biological weapons in the region, but did not specifically address laboratory biosafety and biosecurity.⁸³

Lastly, the Center for Excellence in Disaster Management and Humanitarian Assistance (COE-DMHA) and the Asia-Pacific Center for Security Studies (APCSS) co-hosted a conference on Biosecurity Threats in the Asia-Pacific Region in Waikiki, Hawaii, in August 2005.⁸⁴ A major goal of the meeting was to identify barriers to detect and respond to biological security threats and events. Items discussed include the roles of education and training in preparing for and responding to biological security threats, laboratory quality assurance, and common terminology.

Europe

The September 11, 2001 attacks in the United States and the 2004 Madrid bombings fueled a host of European governmental and institutional initiatives to address terrorism threats. Many of these efforts focus on bioterrorism, with an emphasis on preparedness and response. Nonproliferation and disarmament initiatives include The European Security Strategy: A Secure Europe in a Better World, and the EU Strategy against Proliferation of Weapons of Mass Destruction, both adopted in December 2003. In December 2005, a comprehensive EU Counter-Terrorism Strategy was approved that defines the fight against terrorism as primarily the responsibility of the member states,

⁸² *International and Regional Initiatives to Enhance National Implementation of the Convention*, Fourth Meeting of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction, August 2007, www.vertic.org/assets/nim_docs/events/other/BWC-MSP-2007-MX-INF.2-en.pdf.

⁸³ Ibid.

⁸⁴ Asia Pacific Center for Security Studies, "Conference Program, 2005", <http://www.apcss.org/core/APCSS%20News/releases/2005/biosecurity/Biosecurity05.htm>

but also the European Council, Commission, and the European Parliament.⁸⁵ The Strategy addresses seven areas, one of which is “international cooperation with partners and international organizations on the non-proliferation of chemical, biological, radiological and nuclear (CBRN) materials.” On 27 February 2006, the EU adopted a Joint Action in support of implementation of UNSCR 1540 and the BTWC (EUJA-BTWA), raising awareness and strengthening Member States capacities. While some European countries are in the process of formulating comprehensive national biosecurity strategies or legislation, most European countries have not begun this process.

Out of this heightened awareness, Europe has also developed several laboratory biosafety and biosecurity programs, organizations, and initiatives. Most European biosafety and biosecurity events are collaborative activities shared among multiple institutions and between numerous countries. For example, the European Biosafety Association (EBSA) aims to promote biosafety and biosecurity throughout the European continent. In addition to training and awareness, EBSA also seeks to influence and support emerging legislation and standards in the areas of biological safety, biosecurity, biotechnology, transport, and associated activities.⁸⁶ EBSA has held multiple conferences since 2003, both independently and in association with other major biosafety organizations and institutions, such as the American Biological Safety Association (ABSA), the WHO, and the European Center for Disease Prevention and Control (ECDC). Annual EBSA conferences since 2003 have been held in various European cities. Subjects discussed at these conferences include biosafety risk assessment, containment, safe disposal of biological material, occupational health in biosafety, genetic modification of emerging applications and current concerns, biosafety risk management, decontamination, biosecurity, patient care and nosocomial diseases, automation in biosafety, and setting directions in biosafety.⁸⁷

Biosafety-Europe, a program funded through the European Commission’s Sixth Framework Program (FP6) was established in April 2006 to “co-ordinate, harmonize, and exchange biosafety and biosecurity practices within a pan-European network.”⁸⁸ The project currently has 20 partners, including EBSA, from 11 European countries. The primary objectives of the project include offering recommendations that may be used for future policy making within the European Union (EU), establishing a reference list of BSL3/BSL4 laboratories, assessing the cost-effectiveness of biosafety methods and practices currently used, and developing a program for training and seminars.⁸⁹ The project also involved developing an online questionnaire to gather general information on European containment laboratories and their biosafety and biosecurity practices. In 2007,

⁸⁵ Council of the European Union, “The European Union Counter-Terrorism Strategy”, Justice and Home Affairs Council meeting, Brussels, 1 Dec. 2005.

⁸⁶ European Biosafety Association, <http://www.ebsaweb.eu/>

⁸⁷ European Biosafety Association, “Annual Conferences”, <http://www.ebsaweb.eu/Annual%2BConferences-p-191.html>

⁸⁸ European Biosafety Association, “Biosafety-Europe”, <http://www.ebsaweb.eu/EBSA+Activities-p-185/Biosafety%2BEurope-p-188.html>

⁸⁹ European Biosafety Association, “Biosafety-Europe”, <http://www.ebsaweb.eu/EBSA+Activities-p-185/Biosafety%2BEurope-p-188.html>

two meetings took place in Zurich, Switzerland and Salisbury, United Kingdom to discuss these objectives.

The European Association for Bio-Industries (EuropaBio) is a political association representing over 1800 small and medium sized biotech companies throughout Europe. Prompted by the European Commission, EuropaBio established the European Task Force on Bioterrorism in 2006. The Task Force is comprised of various industries, research institutes, and national associations with an interest in biotech applications related to biosecurity.⁹⁰ The main objectives of the Task Force are to ensure and to improve European capacity to respond to bio-threats by stimulating the biosecurity market and developing public/private partnerships at the national, European, and international levels.⁹¹ EuropaBio has held several seminars and workshops on bio-preparedness in Europe, including, most notably, the Bio-safety, Bio-security and Personnel Security in Europe workshop, held in Brussels in July 2006.⁹²

The Task Force and the European Commission, through the Justice, Freedom and Security Directorate General (JFS DG), also published two green papers related to biosecurity, biosafety, and bio-preparedness. The 2007 *Green Paper on Bio-preparedness* identifies guiding principles how to implement biosecurity, reduce biological risks, and enhance preparedness and response with the aim of creating a European biosecurity strategy.⁹³ The report recommends using available mechanisms, such as peer evaluation, awareness-raising campaigns, and funding to facilitate planning activities before introducing new legislation. The report also suggests using existing structures and organizations to build and conduct implementation activities, and to ensure that preparedness measures are proportionate in relation to the specific threat. The *Green Paper on Detection Technologies* published in 2006 focuses on detection technologies that are useful for detecting and indentifying biological agents.⁹⁴ Together, these reports have had a significant impact on biosafety and biosecurity policies and legislation in Europe. The JFS DG also supported an initiative to develop an international biosafety and biosecurity laboratory biorisk management standard in partnership with ABSA, EBSA, and Det Norske Veritas.⁹⁵

Two organizations from the United Kingdom, the Advisory Committee on Dangerous Pathogens (ACDP) and the Health and Safety Executive (HSE), play a primary role in the development of European biosafety and biosecurity policies, resources, and recommendations. These organizations not only affect the United Kingdom, but also all of Europe. The ACDP is an advisory public body to the UK Department of Health.⁹⁶ The function of the ACDP is "to advise the Health and Safety Commission, the Health

⁹⁰ Europabio, "European Taskforce on BioPreparedness", http://www.europabio.org/eu_biosecurity.htm

⁹¹ Ibid.

⁹² Ibid.

⁹³ Ibid.

⁹⁴ Ibid.

⁹⁵ Kahlau, Frida, "Countering Bio-Threats: EU Instruments for Managing Biological Materials, Technology, and Knowledge" SIPRI Policy Paper 19. August 2007

⁹⁶ UK Department of Health, "Advisory Committee on Dangerous Pathogens (ACDP)", <http://www.advisorybodies.doh.gov.uk/acdp/index.htm>

and Safety Executive, Health and Agriculture Ministers and their counterparts under devolution in Scotland, Wales and Northern Ireland, as required, on all aspects of hazards and risks to workers and others from exposure to pathogens."⁹⁷ The ACDP has held over 10 meetings since 2003. Topics covered during these meetings included, but were not limited to, containment and control work for influenza viruses, design and operation of containment level four laboratories, revision of guidance on management and control of viral hemorrhagic fevers, avian flu public health measures, enhanced surveillance of viruses, respiratory protective equipment in health care settings, and biological safety training programs.^{98,99,100} The HSE, in addition to local governments, is the enforcing authority of the Health and Safety Commission, which is responsible for health and safety regulation in Great Britain. Since 2003, the HSE has published two reports that have direct implications on biosafety and biosecurity practices in Great Britain and Europe. In 2005 HSE published *Biological agents: Managing the risks in laboratories and healthcare premises*,¹⁰¹ and, in 2006 published *Biological agents: The principles, design and operation of Containment Level 4 Facilities*.¹⁰²

The Network Centro Volta-International Working Group (IWG-LNCV) and The Partnership for Global Security (PGS) jointly held a workshop entitled Strengthening a Global Biosecurity/Biosafety Framework and Coping with the Biotechnology Revolution in Como Italy in October 2007.¹⁰³ This workshop created an important forum for discussion, and generated fruitful and positive feedback from a diverse range of governmental and bioscience participants.¹⁰⁴ A variety of key conclusions were drawn from this meeting. These conclusions ultimately led to the November 2007 publication, the *Consensus Statement of Priority Actions for the Promotion of Global Biosecurity*, which highlighted five immediate priorities areas for the global community to enhance biosecurity. These action areas include 1) sharing information on global biological holdings, research facilities, and infectious disease patterns, 2) education and awareness on the nature of the biological threat in the scientific, academic, and policy communities, 3) interdisciplinary coordination in support of the improvement of global biosecurity, 4) private-sector engagement on the risks posed by the potential misapplication of biological

⁹⁷ UK Department of Health, "Advisory Committee on Dangerous Pathogens (ACDP)", <http://www.advisorybodies.doh.gov.uk/acdp/index.htm>

⁹⁸ UK Health and Safety Executive, "Advisory Committee on Dangerous Pathogens (ACDP)", *Advisory Committee on Dangerous Pathogens, Annual Report, 2004*, <http://www.hse.gov.uk/aboutus/meetings/acdp/ar2004.pdf>

⁹⁹ UK Health and Safety Executive, "Advisory Committee on Dangerous Pathogens (ACDP)", *Advisory Committee on Dangerous Pathogens, Annual Report, 2005*, <http://www.hse.gov.uk/aboutus/meetings/acdp/ar2005.pdf>

¹⁰⁰ UK Health and Safety Executive, "Advisory Committee on Dangerous Pathogens (ACDP)", *Advisory Committee on Dangerous Pathogens, Annual Report, 2006*, <http://www.hse.gov.uk/aboutus/meetings/acdp/ar2006.pdf>

¹⁰¹ UK Health and Safety Executive, *Biological agents: Managing the risks in laboratories and healthcare premises*, 2005, www.hse.gov.uk/biosafety/biologagents.pdf

¹⁰² UK Health and Safety Executive, *Biological agents - The principles, design and operation of Containment Level 4 facilities*, 2006, <http://www.hse.gov.uk/pubns/web09.pdf>

¹⁰³ Martellini M, *Fourth International Working Group-Landau Network Centro Volta and Partnership for Global Security Workshop: Strengthening a Global Biosecurity/Biosafety Framework and Coping with the Biotechnology Revolution*, 2007, <http://www.partnershipforglobalsecurity.org/documents/conclusions.pdf>

¹⁰⁴ Ibid.

materials and advanced scientific techniques, and 5) compliance with harmonized biosecurity standards and practices.¹⁰⁵

Numerous other European resources, organizations, and reports on biosafety and biosecurity have also been developed. For example, in 2006, The Netherlands became one of the first countries in the world to adopt and publish a *Code of Conduct for Biosecurity*.¹⁰⁶ The code, drawn up by the Biosecurity Workgroup and inaugurated by the Royal Netherlands Academy of Arts and Sciences, intends to raise awareness among scientists of the potential misuse of their research. The code defines biosecurity responsibilities, calling for awareness, accountability, and oversight targeted mainly at researchers, laboratory workers, managers, and others.¹⁰⁷

Latin America

Many biosafety and biosecurity events in Latin America were hosted by national institutions and international organizations. Several events were sponsored by WHO's Pan American Health Organization (PAHO) and the Food and Agriculture Organization of the United Nations (FAO); however, the majority of events were organized at a national level, rather than at the regional level.

Relative to other Latin American countries, Brazil is very active in laboratory biosafety. The Brazilian Biosafety Association (ANBio) holds a biannual conference, which focuses on biosafety issues related to genetically modified organisms as well as laboratory biosafety and high-risk pathogens. For example, in 2005, several organizations, including the Brazilian Ministry of Health, PAHO, the Fundação Oswaldo Cruz, the Secretaria de Vigilância em Saúde, and the Agência Nacional de Vigilância Sanitária, held the International Health Biosafety Seminar.¹⁰⁸ This seminar included speakers from several national and international organizations, including US CDC, PAHO, WHO, and the US National Institutes of Health (NIH). Topics included biosafety in Latin America, risk assessment, biosafety policies, transport of infectious samples, emerging and re-emerging diseases, introduction to BSL3 and BSL4 laboratories, animal handling and biosafety, biosafety education, and waste management.

Cuba is also relatively active in biosafety topics. The Pedro Kourí Institute in Havana, Cuba held two 80-hour international courses on Laboratory Biosafety in November 2006 and 2007.¹⁰⁹ Additionally, in 2004, the National Center for Biosafety and the Cuban Society of Veterinary Microbiology held an International Biosafety Workshop in Havana.

¹⁰⁵ Martellini M, *Fourth International Working Group-Landau Network Centro Volta and Partnership for Global Security Workshop: Strengthening a Global Biosecurity/Biosafety Framework and Coping with the Biotechnology Revolution*, 2007, <http://www.partnershipforglobalsecurity.org/documents/conclusions.pdf>

¹⁰⁶ Biosecurity working group, *A Code of Conduct for Biosecurity*, 2006, www.knaw.nl/publicaties/pdf/20071092.pdf

¹⁰⁷ Ibid.

¹⁰⁸ Agência Nacional de Vigilância Sanitária (National Health Surveillance Agency), *Seminário Internacional de Biossegurança em Saúde*, www.anvisa.gov.br/divulga/eventos/biosseguranca.pdf

¹⁰⁹ Instituto "Pedro Kourí", 'Plan Internacional, Cursos Regulares "Bioseguridad en los Laboratorios"', <http://www.ipk.sld.cu/cursos/bioseguridad.htm>

This workshop covered a wide range of topics, including achieving a culture of biosafety, safety evaluation, classification of risk and laboratories, laboratory design, equipment, security systems, risk analysis, environmental monitoring, and dangerous biological waste.¹¹⁰

PAHO has been influential in promoting laboratory biosafety and biosecurity in Latin America through workshops, resources, and publications. Since 2003, PAHO has held two regional Biosafety and Laboratory Biosecurity Awareness Workshops. In August 2005, PAHO held an event, “Strengthening of Capacity and Biosafety Capacity in Public Health Laboratories,” in Brazil. In October 2006, PAHO held a Train the Trainer workshop, “Implementation of a Management System for Quality in Laboratories in Guatemala.”¹¹¹ PAHO has also developed a number of resources and publications. In 2005, PAHO developed the Course in Quality Management for Laboratories,¹¹² an online course in Spanish that also offers an informational CD, slides, and other educational material. This course is composed of 11 modules, specifically including Laboratory Equipment, and Materials and Biosafety. In 2005, PAHO published the *Maintenance Manual for Laboratory Equipment and Biosafety Cabinets: Use, Disinfection, and Maintenance*; more recently in 2007, PAHO published *Latin American Guide for the Implementation of a Code of Ethics in Health Laboratories*.¹¹³

In 2007, the FAO Regional Office for Latin America and the Caribbean held a Regional Training Workshop, “Integrated Approach and Evaluation of Training Requirements for Food Safety, Plant Health, and Animal Health (Biosafety)” in Santiago, Chile. This workshop included some presentations on the principles and components of laboratory biosafety. That same year, the FAO held another Regional Training Workshop for Latin America on an Integrated Biosafety/Biosecurity Approach in Santiago, Chile. While this workshop encompassed “farm to fork” biosecurity topics, laboratory issues and risk analysis were also covered.¹¹⁴ Other FAO Latin American activities include organizing the “International Workshop: Training in Epidemiology, Surveillance and management of Poultry and Wild Birds for the Early Detection of Highly Pathogenic Avian Influenza in the Americas” in conjunction with the Wildlife Conservation Society. Held in 2007 in Kingston, Jamaica, this workshop provided training in epidemiology and surveillance of avian influenza, including appropriate biosafety practices and equipment.¹¹⁵

¹¹⁰ El Centro Nacional de Seguridad Biológica y La Sociedad Cubana de Microbiología Veterinaria, “Taller Internacional de Bioseguridad”, <http://www.veterinaria.org/asociaciones/accvcuba/bioseguridad.htm>

¹¹¹ Pan American Health Organization, “OPS: Es hora de darle un fuerte impulso a los laboratorios,” <http://www.ops.org.bo/servicios/?DB=B&S11=8870&SE=SN>

¹¹² Pan American Health Organization, Curso de Gestión de Calidad para Laboratorios, <http://www.paho.org/Spanish/ad/thse/ev/labs-CGC.htm>

¹¹³ Pan American Health Organization, “Technical Documents”, http://www.ops-oms.org/Project.asp?SEL=TP&LNG=ENG&ID=208&PRGRP=docs_gen

¹¹⁴ Food and Agriculture Organization of the United Nations, “Taller de Capacitación Regional de la FAO,” ftp://ftp.fao.org/ag/agn/food/meetings/2007/santiago_draft_es.pdf

¹¹⁵ Food and Agriculture Organization of the United Nations and the Wildlife Conservation Society, “International Workshop: Training in Epidemiology, Surveillance and management of Poultry and Wild Birds for the Early Detection of Highly Pathogenic Avian Influenza in the Americas,” www.rlc.fao.org/es/prioridades/transfron/aviar/pdf/Rep-vi.pdf

Middle East

As in Africa, the Middle East has only recently been exposed to laboratory biosafety and biosecurity, lagging behind other regions in the number of conferences, trainings, and workshops conducted since 2003. Government agencies from the United States and the United Kingdom have been responsible for hosting the majority of biosafety and biosecurity events in this region.¹¹⁶ One of the most recent conferences hosted by an international organization was the “Biosafety and Biosecurity International Conference 2007: A Seminar for the Life Sciences and Policy Communities in the Gulf, Middle East and North Africa” in Abu Dhabi in November 2007.¹¹⁷ Over 100 experts from 18 Middle Eastern countries, the United States, Canada, Germany, Japan, Sweden, the United Kingdom, and Sweden were in attendance.¹¹⁸ Other Middle Eastern conferences and workshops include a 2006 WHO Eastern Mediterranean Regional Office (EMRO) Laboratory Biosafety and Laboratory Biosecurity Awareness Workshop held in Iran and previously mentioned workshops hosted by Interpol and the WFCC.

Russia and the Newly Independent States

Since Russia formally acknowledged the Soviet Union’s former clandestine biological weapons program in the early 1990’s, efforts have ensued to ensure safe dismantlement of the offensive program, and increase biosafety and biosecurity practices for legitimate laboratories in Russia. Various organizations, representing multiple countries, are currently involved in these initiatives in both Russia and the Newly Independent States (NIS). Since 2003, there have been numerous non-proliferation activities, conferences, and workshops held on biosafety and biosecurity topics.

This assistance is provided by a number of global players. Many states contribute to the nonproliferation and disarmament efforts directly through the Group of Eight (G8) Global Partnership against the Spread of Weapons and Materials of Mass Destruction; the European Union, specifically, contributes to the Technical Assistance to the Commonwealth of Independent States (TACIS) program. The US contribution is the most extensive among all donor countries. The US program is managed by the US Department of Defense (under the Biological Weapons Proliferation Prevention Program), the US Department of State (under the Bio-Industry Initiative, Bio-Chem Redirect and Science Center program) and the US Department of Energy (DOE) (under the Initiatives for Proliferation Prevention programs). These programs will not be considered in this report. Other nations, including Canada, France, and the United Kingdom, are becoming increasingly active in this region.

¹¹⁶ Many programs have been sponsored by the US Department of Energy (DOE), US Department of State Biosecurity Engagement Program (DOS BEP), US Sandia National Laboratories International Biological Threat Reduction program (SNL IBTR), and the UK Defence Science and Technology Laboratory.

¹¹⁷ This meeting was hosted by ICLS and the Environmental Agency of Abu Dhabi. Biosafety and Biosecurity International 2007, <http://www.biosafetyandbiosecurity-2007.org/>

¹¹⁸ Ibid.

Both the International Science and Technology Center (ISTC) in Moscow and the Science and Technology Center in Ukraine (STCU) promote nonproliferation by redirecting weapons scientists from Russia and the NIS towards peaceful scientific research and innovation by facilitating cooperation between scientists and Western states. In September 2004, the ISTC hosted a landmark meeting, the “Biosafety, Biosecurity, and Nonproliferation Workshop for Central Asia and the Caucasus” in Almaty, Kazakhstan. This meeting was held to provide biological nonproliferation training to government officials and public health workers of the Central Asian and Caucasus regions. The workshop provided training to nearly 80 scientists and government officials from Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, and Turkmenistan, as well as many key leaders from international organizations.

Canada has been a leader in promoting biosafety and biosecurity in this region by engaging in focused training, developing appropriate standards and guidelines, and establishing physical containment measures. Canada has funded several biotechnology and life science projects through the ISTC. In 2004, Canada held a Canadian Biological Sciences Colloquium in Moscow. This provided the opportunity for 17 officials and scientists from Canada to introduce Canada’s Biotechnology and Life Sciences research priorities to 120 former BW scientists from Armenia, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Russia, and Tajikistan (Canada has provided approximately USD \$400,000 to biological projects for the STCU). Canada has also helped establish the Biosafety Association for Central Asia and the Caucasus (BACAC).¹¹⁹ They have also completed visits of priority institutes in 2006, and identified the facilities in most pressing need of biosecurity and biosafety upgrades. Canada is exploring the possibility of supporting the construction of new facilities to ensure proper storage and security of dangerous pathogens. Canada is also responsible for translating many key biosafety and biosecurity reference materials into Russian, including the *Canadian Laboratory Biosafety Guidelines* (third edition, 2004), and the Containment Level 3 Facilities training video of the Office of Laboratory Security, Public Health Agency of Canada.

In addition to the Kazakh conference, another workshop was held at the Canadian Science Centre for Human and Animal Health (Biosafety Level 4 facility) in Winnipeg, Manitoba, in October 2004 on “Biosafety in High Containment Laboratories.” Attending the workshop were 13 scientists from institutes in Russia, Kyrgyzstan, and Tajikistan. The workshop focused on best practices in biosafety and included an exchange on views on biocontainment issues. Biosafety and biocontainment lectures and hands-on training modules were also performed.

The Landau Network-Centro Volta (LNCV) is a high-level, worldwide, non-profit, nongovernmental organization for scientific and cultural cooperation with institutions and scientific communities of the former Soviet Union and Asian countries. In April 2005, the Russian American Nuclear Security Advisory Council (RANSAC) and LNCV held a meeting on “Advancing International Cooperation on Bio-Initiatives in Russia and the

¹¹⁹ Foreign Affairs and International Trade Canada, “Biological Non-Proliferation”, <http://geo.international.gc.ca/cip-pic/library/biological-en.aspx>

CIS” in Rome, Italy. The event was held with the support of the governments of the United States, Canada, Italy, and the United Kingdom, and with the cooperation of the ISTC in Moscow, Russia. The participants included government officials and academic experts from western countries, and biological scientists and biosecurity experts from Russia, Kazakhstan, and Uzbekistan. The event was the second in a series of meetings on how to further cooperation between these governments and non-governmental organizations (NGOs) to prevent biological terrorism by promoting biosecurity, biosafety, and the involvement of commercial entities in key biological institutes.

In September 2005, the Geneva Centre for Security Policy (GCSP) and the Moscow-based PIR Center conducted a workshop on biosecurity and biosafety. The objective of the workshop was to discuss possible avenues of cooperation between Switzerland and Russia in these fields, particularly with regard to converting the Russian biosecurity complex to peaceful purposes. The workshop was attended by a number of Swiss and Russian experts in the fields of biosecurity and biosafety.

Two conferences and workshops previously mentioned in this report include the September 2006 Moscow workshop hosted by OECD and the Russian Federation entitled “Biosecurity of Microbial Biological Resources – Complementing Innovation”, as well as the “Enhancing Biosafety and Biosecurity: Developing National and International Strategies” seminar in Moscow in November 2006. It was at this latter seminar that ICLS announced the development of the International Advisory Working Group (IAG) on Biosafety and Biosecurity composed of local Russian partners and international experts to promote the enhancement of biosafety and biosecurity on an international, regional, and national level.¹²⁰

International Advisory Group (IAG) on Biosafety and Biosecurity

In 2006, the I.M. Sechenov Moscow Medical Academy (Russia’s largest educational institution in medicine and pharmacology), NP TEMPO (Non-commercial Partnership, Technology, Education, Marketing, Production and Optimization, a scientific non-governmental consortium of Russian life science organizations), and the ISTC partnered with the Global Partnership Program (GPP) of Foreign Affairs Canada and established the International Advisory Working Group (IAG) on Biosafety and Biosecurity.¹²¹

The purpose of this group is to provide sustained engagement on biosafety and biosecurity in Russia and Central Asia through national and international conferences, workshops, round-tables, and other activities.^{122,123} Specific aims of the IAG include increasing awareness of biosecurity and biosafety; assessing and offering expertise on biosafety and biosecurity according to international standards; providing

¹²⁰ International Council for Life Sciences, “ICLS Events”, <http://www.iclscharter.org/events.html>

¹²¹ International Council for Life Sciences, “ICLS Events”, <http://www.iclscharter.org/events.html>

¹²² *ICLS Fall 2007 Newsletter*, Volume 1, Issue 1, http://www.iclscharter.org/images/ICLS_News_Fall_07.pdf

¹²³ *ICLS Fall 2007 Newsletter*, Volume 1, Issue 1, http://www.iclscharter.org/images/ICLS_News_Fall_07.pdf

recommendations for use by foreign agencies and other international entities as needed; and assisting, as needed, in the implementation of new biosafety and biosecurity programs and activities. The IAG group consists of Russian experts from scientific research organizations and private companies, and international experts from the United States, Germany, United Kingdom, Sweden, Singapore, Switzerland, Kazakhstan, Kirgizia, and Japan.^{124, 125} Representative organizations also include the ICLC, GPP, ISTC, UK Health Protection Agency, WHO, OECD, and US CDC.^{126, 127} IAG is organized into the following six specialized subgroups:

1. General Issues of Biosafety and Biosecurity
2. Education and Training and Public Awareness
3. Specific Topics of Biosafety and Biosecurity
4. Biosecurity and Biosafety at Biotechnological Pharmaceutical Facilities
5. Individual Biosecurity and Biosafety
6. Emerging and Re-emerging Infectious Disease¹²⁸

¹²⁴ *ICLS Fall 2007 Newsletter*, Volume 1, Issue 1, http://www.iclscharter.org/images/ICLS_News_Fall_07.pdf

¹²⁵ NP Tempo, *IAG Newsletter*, Autumn 2007, <http://eng.nptemp.ru/iag/>

¹²⁶ *ICLS Fall 2007 Newsletter*, Volume 1, Issue 1, http://www.iclscharter.org/images/ICLS_News_Fall_07.pdf

¹²⁷ NP Tempo, *IAG Newsletter*, Autumn 2007, <http://eng.nptemp.ru/iag/>

¹²⁸ NP Tempo, *IAG Newsletter*, Autumn 2007, <http://eng.nptemp.ru/iag/>

Part III. Metrics of Success

It is difficult to define or measure the success of the many laboratory biosafety and biosecurity events that have occurred since 2003. However, it is indisputable there is a greater knowledge and commitment to laboratory biosafety and biosecurity in the scientific community than ever before. The number of conferences, trainings, courses, and workshops devoted to these areas has grown substantially in the last five years, reaching many under-developed regions of the world for the first time. International meetings, which traditionally host a small number of participants from multiple countries, have sparked an increase in regional and national meetings that include a larger number of participants, creating a denser, more localized knowledge base.

The number of biocontainment laboratories is growing around the world. Although the United States has the most BSL3 laboratories, many other countries are witnessing a similar trend. Brazil is building a network of 12 BSL3 public health laboratories, and seven BSL3 agricultural health laboratories.¹²⁹ Indonesia had two BSL3 laboratories (associated with vaccine production facilities) in 2005, but now it has at least six for research and diagnostic purposes. The government of Egypt does not currently have any BSL3 laboratories, but efforts are underway to construct at least six BSL3s in the immediate future, and in India, the number of BSL3 laboratories tripled from five to 16 in 2006.¹³⁰ New biocontainment laboratories can reduce biorisks in several key ways. These labs often have better biosecurity than more basic biosafety laboratories since access is typically significantly more restricted for safety reasons. The construction of these laboratories can also be an indicator of increased government support for improving a country's indigenous capability to manage the biorisks of highly infectious biological materials. Lastly, laboratory biosafety and biosecurity may be improved if an institution moves their existing scope of work from a basic laboratory into a biocontainment laboratory.

In addition, the internet has become a critical tool providing access to a vast assortment of online resources with links to biosafety and biosecurity reference manuals, tools, and guidelines, many of which have been translated in multiple languages and are accessible to anyone in the world with internet access. A simple internet review provides clear evidence that interest in these areas is growing internationally. For example, the third edition of the WHO *Laboratory Biosafety Manual* webpage was accessed 40,123 times in 2005; yet within the first five months of 2008, the number has climbed to a staggering 347,814 hits.¹³¹ This annual increase is fairly consistent among each of the 10 translated versions. Similarly, the WHO *Biorisk Management: Laboratory Biosecurity Guidance*

¹²⁹ Leila Oda, "Biosecurity and Biosafety: an Experience from the South on Capacity Building," Latin America Laboratory Biosafety and Biosecurity Conference, Brazil, May 2008.

<http://www.biosafetyandbiosecurity.org>

¹³⁰ Prevasini N. Presentation at the Latin America Biosafety and Biosecurity Conference. The WHO Global Biosafety and Laboratory Biosecurity program. Rio de Janeiro, Brazil. 13-15 May 2008

¹³¹ Nicoletta Prevasini, personal communication, May 2008.

webpage was accessed 3,990 times in 2006, doubling to 8,777 hits in 2007.¹³² The number of references to laboratory biosafety and biosecurity has also increased in recent years; a general search of “laboratory biosafety” in the US National Library of Medicine reveals a two and four fold increase in the number of publications during 2003-2008 compared to 1998 – 2002 and 1993-1997, respectively. A similar search of “laboratory biosecurity” found four times the number of publications in 2003-2008 compared to 1998-2002; a search of 1993-1997 found no publications containing this term.¹³³

Governments have also taken notice of the importance of laboratory biosafety and biosecurity. The recent terrorist attacks that have hit the United States, Europe, and Asia have demonstrated to political leaders the need for enhanced awareness in these areas. This attention has prompted major economic and political initiatives by governments and organizations to minimize the consequences of these biological risks. As a result, numerous international and national legislative initiatives have poured out of this concern. Examples of national biosafety and biosecurity legislation include the UK’s “Anti-Terrorism, Crime, and Security Act of 2001,” which places legal obligations on the scientific community to regulate the transfer of biological materials and the security of pathogens and toxins. In 2007, Japan revised and re-enacted its “Infectious Diseases Control Law,” which added more infectious diseases to its country’s watch list, re-categorized existing infectious diseases, and established new provisions for regulating control of these pathogens. India passed the “Weapons of Mass Destruction (WMD) and Their Delivery Systems Bill” in 2005, prohibiting all unlawful activity related to WMD, including their means of delivery and dual-use materials, equipment, and technology. Singapore has also enacted strict regulatory requirements for laboratory biosafety and biosecurity, implemented in the “Biological Agents and Toxins Act” of 2005. In July 2008, Denmark enacted a law that regulates the possession, the manufacture, use, storage, sale, distribution, transport and disposal of any biological agent, delivery system and related material that could be used in a biological attack. Many other countries are starting to enact similar national measures.

Yet the lack of coordination has made it difficult to harmonize these measures, and their impact has been limited. For example, the AG, as well as the OECD, cannot and do not undertake any legally binding obligations: the effectiveness of their cooperation depends solely on a shared commitment to CBRN nonproliferation goals and the strength of their respective national measures. For example, the Australia Group does not include a number of high-risk countries. Several developing countries also oppose the group’s existence on political grounds, claiming that it is discriminatory and unfairly impedes their economic development.

In another example, progress on the implementation of UNSCR 1540 has been slow and its success has been mixed at best. A UN report notes “major variations exist in the implementation of obligations with respect to the three categories of weapons of mass destruction and their means of delivery.”¹³⁴ After almost four years, 51 countries are yet

¹³² Ibid.

¹³³ US National Library of Medicine, <http://www.ncbi.nlm.nih.gov/pubmed/>

¹³⁴ UNSC Report S/2006/257, <http://www.un.org/sc/1540/>

to even submit a report regarding the status of their national legal infrastructure concerning WMD-related materials. Still fewer are in compliance with all components of the Resolution. Commonly cited reasons for non-compliance are the “insufficient understanding of their obligations under resolution 1540... as well as the lack of capacity to fulfill its requirements. Some States also highlighted differences in setting national priorities.”¹³⁵ The low frequency of adequate legal and penal frameworks, and disparities across issue areas contained in the Resolution, indicate that much work remains to be accomplished in the implementation of UNSCR 1540, and may be indicative of a lack of willingness or commitment for countries to move beyond awareness-raising and rhetoric to implementation.

¹³⁵ Ibid.

Conclusions

Laboratory biosafety and biosecurity implementation is poor in many regions of the world, in both developed and developing regions. American laboratories handling the world's deadliest germs and toxins have experienced more than 100 bio-accidents involving such high-risk agents as *Bacillus anthracis*, highly pathogenic avian influenza, monkeypox, and *Yersinia pestis* since 2003, and the number is increasing as more laboratories across the country are approved to do the work. Biosecurity infractions are also numerous. Prior to enhanced US legislation, the US Department of Agriculture (USDA) reported 124 of its research labs were vulnerable to theft, and their stocks of animal and plant pathogens were not accounted for properly. Many unauthorized persons, including those "not associated with USDA work" also had regular access to sensitive areas.¹³⁶ Texas A&M was also cited for a variety of biosecurity problems in 2006, ranging from unauthorized access to high security labs, missing vials of infectious diseases, including *Brucella* bacteria, improper disposal of infected animals, negligence in using personal protective equipment, and failure to report exposure of laboratory workers to dangerous biological agents.^{137,138} In Europe, 33 of 35 Danish laboratories evaluated had open access to freezers containing lethal viruses and bacteria, such as *Bacillus anthracis*, and 90% of the laboratories studied did not conduct regular inventory checks or perform personnel background checks.¹³⁹ Moreover, Institutional Biosafety Committees (IBC), which should be responsible for ensuring compliance to good laboratory biosafety and biosecurity, are only mandated to provide oversight on recombinant DNA research. In addition, most are often under-funded, under-staffed, and under-trained. A 2003 survey found only 21% of IBCs in the United States reported that their members had training in biosafety and 64% had less than one full-time equivalent staff member.¹⁴⁰

It is an immense challenge to improve international laboratory biosafety and biosecurity. To compound the lack of financial resources in many regions, other hurdles include operational and oversight laxity, personnel liability, and an overall low level of awareness or concern in many laboratories around the world. A survey conducted by Sandia National Laboratories and Bioinformatics LLC of more than 300 Asian scientists and researchers in 2007 revealed that a majority of respondents do not worry about a security breach in their facilities, and consequently practice only simple biosafety and biosecurity measures. Approximately two-thirds of respondents who study Japanese encephalitis, highly pathogenic avian influenza, and severe acute respiratory syndrome use only BSL2

¹³⁶ CIDRAP News, "Security at many USDA labs called poor", 2002, <http://www.cidrap.umn.edu/cidrap/content/bt/bioprep/btwatch/btwatch-may.html>

¹³⁷ Ramshaw, E. "CDC reprimands Texas A&M over lab safety", 2007. Dallas News, <http://www.dallasnews.com/sharedcontent/dws/dn/latestnews/stories/090507dntexcdc.9f66c8cc.html>

¹³⁸ Kaiser, J, "Pathogen Work at Texas A&M Suspended", 2007, ScienceNOW Daily News, <http://sciencenow.sciencemag.org/cgi/content/full/2007/702/1>

¹³⁹ Nuclear Threat Initiative, "Danish Labs Open to Biological Theft, Study Finds", 2006, http://204.71.60.36/d_newswire/issues/2007_4_9.html#ED507E81

¹⁴⁰ Cook-Deegan et al., *Issues in Biosecurity and Biosafety*, 2005, Science, <http://www.sciencemag.org/cgi/content/full/sci;308/5730/1867c>

facilities; furthermore, 21% of respondents do not know what BSL they use. Alarming, nearly 50% of respondents reported that if a particular piece of needed safety equipment is not available, they will perform the experiment anyway. Other results found approximately 50% posted guards at their buildings, lighted the buildings at night, locked their cabinets, and/or used control devices. A mere 34% reported locking their refrigerators. Fifty-one percent consistently restricted access to their laboratory areas, and just two-fifths knew which employees had authorized access to the agents.¹⁴¹ Surveys of researchers from Latin America, the Middle East, and Eastern Europe revealed comparable findings.¹⁴²

These and other similar incidents of laboratory biosafety and biosecurity vulnerability were recognized at the BTWC Meeting of Experts in 2003. This awareness and concern prompted members to further discuss these issues at the 2008 BTWC intercessional meeting with hopes to mitigate the associated biological threat through promotion of awareness, education, and codes of conduct.¹⁴³ A review of the major biosafety and biosecurity events since 2003 described in this report reveals considerable growth in the number of international and regional conferences, workshops, training legislation, and publications in the past decade.

Yet measuring the success of these activities is difficult to ascertain primarily because it is impossible to qualitatively or quantitatively evaluate the effectiveness of risk mitigation, especially deterrence, in routine practices of an individual laboratory. Furthermore, there is very little information available in the open-source literature reporting the number of biosafety accidents and biosecurity breaches worldwide. Most available information comes from the United States, a country with one of the most stringent safeguards in place.

The terrorist attacks of the past decade have reinforced the notion that biological terrorism is truly a global problem. The rapid advancement in biotechnology, the emergence and reemergence of deadly, high-consequence infectious diseases and the concomitant increase in high-risk pathogenic research, and the transnational expansion of extremist ideology and terrorist activity suggest that the biological threat will continue to grow. To reduce the biological threats associated with laboratory biosafety and biosecurity, complementary and coordinated international measures are critical. Measures should be developed in a multilateral framework, with the BWTC in close cooperation with the international community, including such international organizations as the FAO, the OECD, the OIE, and the WHO to raise global awareness of the issues involved and engage and enforce all nation-states to prevent proliferation.

¹⁴¹ Sandia National Laboratories. *A Survey of Asian Life Scientists: The State of Biosciences, Laboratory Biosecurity, and Biosafety in Asia.*, SAND2006-0842 Edn Sandia National Laboratories, 2006. <http://www.biosecurity.sandia.gov/main.html?subpages/documents.html>

¹⁴² Sandia National Laboratories. *Surveys of Life Scientists from Eastern Europe, Latin America and the Middle East.* 2007 (manuscript in progress)

¹⁴³ "Final Report", *Sixth Review Conference of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction*, BWC/CONF.VI/6, December 2006, <http://www.opbw.org/>

APPENDIX IA: Summary of Key International Conferences, Workshops, and Trainings

Summary of key international laboratory biosecurity and biosafety conferences, workshops, and trainings since 2003.

Conferences, Workshops and Trainings					
International Organization*	2008	2007	2006	2005	2004
InterAcademy Panel on International Issues (IAP)	2 nd International Forum on Biosecurity -Budapest, Hungary			International Forum on Biosecurity - Como, Italy	
International Committee of the Red Cross (ICRC)				Preventing Hostile Use of the Life Sciences - Kuala Lumpur, Malaysia Biotechnology: Preventing Harmful Use of the Life Sciences - Moscow, Russia	Preventing Hostile Use of the Life Sciences - London, England
Interpol		Interpol Workshop on Preventing Bioterrorism - Muscat, Oman	Interpol Workshop on Preventing Bioterrorism - Kiev, Ukraine Americas Regional Workshop on Preventing Bioterrorism - Santiago, Chile Asian Regional Workshop on Preventing Bioterrorism - Singapore	The 1st Interpol Global Conference on Preventing Bioterrorism - Lyon, France Regional Workshop for African countries - Cape Town, South Africa	

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The Organization for Economic Cooperation and Development (OECD)			Biosecurity of Microbial Biological Resources – Complementing Innovation - Moscow, Russia		Promoting Responsible Stewardship in the Biosciences: Avoiding Potential Abuse of Research and Resources - Frascati, Italy
World Federation for Culture Collections (WFCC)		ICCC-11 - Goslar, Germany			ICCC-10 - Tsukuba, Japan <hr/> Management of Culture Collections of Microorganisms - Rabat, Morocco

*Many of these events were co-hosted by additional organizations not mentioned here. Please consult the text for additional information

Appendix IB. Summary of Key International Publications, Resources, Initiatives, and Legislation

Summary of key international laboratory biosecurity and biosafety publications, resources, initiatives and legislation since 2003.

Publications, Resources, Initiatives, and Legislation						
International Organization	2008	2007	2006	2005	2004	2003
Australia Group (AG)				<i>Australia Group Information System</i>		
Food and Agriculture Organization of the United Nations (FAO)						<i>Biosafety Resources website</i>
InterAcademy Panel on International Issues (IAP)				<i>IAP Statement on Biosecurity</i>		
International Committee of the Red Cross (ICRC)					<i>Preventing hostile use of the life sciences: From ethics and law to best practice</i>	
International Union of Microbiological Societies (IUMS)			<i>IUMS Code of Ethics against the Misuse of Scientific Knowledge, Research, and Resources</i>			
Interpol		<i>Bioterrorism Incident Pre-Planning & Response Guide</i>	<i>Bioterrorism Prevention Resource Center website</i>		Bioterrorism Prevention Program	

The Organization for Economic Cooperation and Development (OECD)		<i>OECD Best Practice Guidelines for Biological Resource Centers (including OECD Best Practice Guidelines on Biosecurity for BRCs)</i>		<i>BiosecurityCodes</i> website		
United Nations Security Council (UNSC)					UNSCR 1540	
World Health Organization (WHO)		<i>Guidance on regulations for the Transport of Infectious Substances 2007-2008</i>	<i>Biorisk Management: Laboratory Biosecurity Guidance</i>	World Health Assembly 58.29 Enhancement of Laboratory Biosafety	<i>Laboratory Biosafety Manual, Third Edition</i> <i>Transport of Infectious Substances</i>	
World Organization for Animal Health (OIE)	<i>Quality Standard and Guidelines for Veterinary Laboratories; Infectious Diseases</i>	<i>The Terrestrial Animal Health Code; Aquatic Animal Health Code</i>	<i>Manual of Diagnostic Tests for Aquatic Animals</i>	<i>Manual of Diagnostic Tests and Vaccines for Terrestrial Animals</i>		

APPENDIX II: Key Regional Events: Africa

Summary of key African regional laboratory biosecurity and biosafety events during 2003-2008.

Organization	Conferences and Workshops	Publications	Resources
African Biosecurity Project (ABP)		<i>Nairobi Announcement, 2007</i>	
African Field Epidemiology Network (AFENET), US Centers for Disease Control (CDC), US Agency for International Development (USAID)			“A Healthier Africa” Laboratory Training Course – Instruction Manual , 2007
European Union Joint Action in support of the BWTC (EUJA-BWTC)	Regional seminar in support of the BTWC for Southern and Eastern Africa - Nairobi, Kenya (2006)		
	Regional seminar in support of the BTWC for West and Central Africa - Dakar, Senegal (2007)		
International Council for the Life Sciences (ICLS)	Biosafety and Biosecurity International Conference 2007: A Seminar for the Life Sciences and Policy Communities in the Gulf and Middle East and North Africa - Abu Dhabi, United Arab Emirates (2007)		
International Council For Science-Africa (ICSU)		<i>Kampala Compact: The Global Bargain for Biosecurity and Bioscience, 2005</i>	
Interpol	Regional Workshop for African countries - Cape Town, South Africa (2005)		
World Federation for Culture Collections (WFCC)	Management of Culture Collections of Microorganisms - Rabat, Morocco (2004)		

WHO African Regional Office (WHO-AFRO)	Biosafety and Laboratory Biosecurity Awareness Workshop - Nairobi, Kenya (2007)		
	Atelier Regional sur les Principes et Pratiques en Securite et Surete Biologiques au Laboratoire - Johannesburg, South Africa (2008)		
	Biosafety and Laboratory Biosecurity Awareness Workshop - Nairobi, Kenya (2008)		

APPENDIX III: Key Regional Events: Asia

Summary of key Asian regional laboratory biosecurity and biosafety events during 2003-2008.

Organization	Conferences and Workshops	Publications	Resources
Asia-Pacific Biosafety Association (A-PBA)	Inaugural Scientific Conference - Biosafety in Asia - Singapore (2006)		
	2nd Scientific Conference - Emerging Trends in Biosafety - Singapore (2007)		
	3 rd Scientific Conference - Biosafety Issues in Emerging and Re-emerging Diseases - Bangkok, Thailand (2008)		
Asia-Pacific Center for Security Studies (APCSS)	Biosecurity Threats in the Asia-Pacific Region - Waikiki, Hawai'i (2005)		
Australian Department of Defense and Indonesian Department of Foreign Affairs	2 nd BWC Regional Workshop - Bali, Indonesia (2006)		
European Union Joint Action in support of the BWTC (EUJA-BWTC)	Regional seminar in support of the BTWC for Asia and the Pacific Islands - Bangkok, Thailand (2006)		
Interpol	Asian Regional Workshop on Preventing Bioterrorism - Singapore (2006)		
Malaysian Science and Technology Research Institute for Defense (STRIDE) and 11 partners	Bio-Safety and Security in Asia (BIOSECASIA) - Kuala Lumpur, Malaysia (2007)		
Sandia National Laboratories International Biological Threat Reduction (SNL IBTR), Thai National Institute of Animal Health	The Asia Conference on Laboratory Biosafety and Biosecurity - Bangkok, Thailand (2007)		

Southeast Asia Regional Center for Counter-Terrorism (SEARCCT), Japan International Cooperation Agency (JICA)	Training Course on Prevention and Crisis Management of Biological Terrorism - Kuala Lumpur, Malaysia (2005)		
	Global awareness-raising for biosafety and laboratory biosecurity: Southeast Asian Regional Office and Western Pacific sub-Regional Office workshop - Singapore (2005)		
	Training Course on Prevention and Crisis Management of Chemical and Biological Terrorism - Kuala Lumpur, Malaysia (2007)		
WHO Southeast Asian Regional Office (WHO-SEARO)	Biosafety and Laboratory Biosecurity Awareness Workshop - Pune, India (2008)		
WHO Western Pacific Regional Office (WHO-WPRO)	Biosafety and Laboratory Biosecurity Awareness Workshop - Singapore (2005)	<i>A Practical Guide for SARS Laboratories: From sample collection to shipment (2003)</i>	
	Biosafety and Laboratory Biosecurity Awareness Workshop - Kuala Lumpur, Malaysia (2008)		
	Biosafety and Laboratory Biosecurity Awareness Workshop - Fiji (2008) (planned)		

APPENDIX IV: Key Regional Events: Europe

Summary of key European regional laboratory biosecurity and biosafety events during 2003-2008.

Organization	Conferences and Workshops	Publications	Resources
Europabio/European Task Force on Bio-preparedness/ European Commission	Workshop on Transportation and Traceability of Bio-materials - Brussels, Belgium (2006)	<i>Green Paper on Detection Technologies</i> , 2006	
	Bio-Preparedness in Europe - Brussels, Belgium (2006)	<i>Green Paper on Bio-preparedness</i> , 2007	
	Bio-Preparedness Workshop - Brussels, Belgium (2008)		
European Biosafety Association (EBSA)	6th Annual Conference of the European Biosafety Association - The Architecture of Biosafety: Design, Construction, Operations and Management of Level 2 and Level 3 Facilities - Lyon, France (2003)		
	7th Annual Conference of the European Biosafety Association - Biosafety risk assessment, containment and safe disposal - Prague, Czech Republic (2004)		
	8th Annual Conference of the European Biosafety Association - Occupational Health in biosafety, Genetic modification: emerging applications and current concerns, Risk management - Barcelona, Spain (2005)		
	9th Annual Conference of the European Biosafety Association - Vaccine development, decontamination, biosecurity, patient care and nosocomial diseases, automation in biosafety, setting directions in biosafety - The Hague, The Netherlands (2006)		
	10th Annual Conference of the European Biosafety Association - Heidelberg, Germany (2007)		
	11th Annual Conference of the European Biosafety Association - Florence, Italy (2008)		

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Interpol	The 1st Interpol Global Conference on Preventing Bioterrorism - Lyon, France (2005)		
Landau Network Centro Volta (LNCV) and The Partnership for Global Security (PGS)	Strengthening a Global Biosecurity/Biosafety Framework and Coping with the Biotechnology Revolution - Como, Italy (2007)		
The Poland Military Institute of Hygiene & Epidemiology Biological Threats Identification & Countermeasure Center	IV International Conference “Protection against Bioterrorism” - Pulawy, Poland (2006)		
Royal Netherlands Academy of Arts and Sciences		<i>Biosecurity Code of Conduct, 2007</i>	
United Nations Institute for Disarmament Research (UNIDIR), Stockholm International Peace Research Institute (SIPRI), International Security Information Service, Europe (ISIS-Europe)	Strengthening European Action on WMD Non-proliferation and Disarmament: How Can Community Instruments Contribute? - Brussels, Belgium (2005)		
UK Health and Safety Executive (HSE)		<i>Biological agents: Managing the risks in laboratories and healthcare premises, 2005</i>	
		<i>Biological agents: The principles, design and operation of Containment Level 4 Facilities, 2006</i>	

APPENDIX V: Key Regional Events: Latin America

Summary of key Latin regional laboratory biosecurity and biosafety events during 2003-2008.

Organizations	Conferences and Workshops	Publications	Resources
Brazilian Biosafety Association	III Brazilian Biosafety Congress - Recife, Brazil (2003)		
	IV Brazilian Biosafety Congress - Porto Alegre, Brazil (2005)		
	V Brazilian Biosafety Congress - Ouro Preto, Brazil (2007)		
Brazilian Ministry of Health, Pan-American Health Organization (PAHO), Fundação Oswaldo Cruz, Secretaria de Vigilância em Saúde, Agência Nacional de Vigilância Sanitária	International Health Biosafety Seminar - São Paulo, Brazil (2005)		
European Union Joint Action in support of the BWTC (EUJA-BWTC)	Regional seminar in support of the BTWC for Latin America and the Caribbean - San Jose, Costa Rica (2007)		
FAO Regional Office for Latin America and the Caribbean	Regional Training Workshop, “Integrated Approach and Evaluation of Training Requirements for Food Safety, Plant Health, and Animal Health (Biosafety)” - Santiago, Chile (2007)		
	Regional Training Workshop “Integrated Biosafety/Biosecurity Approach” - Santiago, Chile (2007)		

Interpol	Americas Regional Workshop on Preventing Bioterrorism - Santiago, Chile		
General Management for Livestock Services (Dirección General de Servicios Ganaderos)	Biosafety in Veterinary Diagnostic Laboratories - Uruguay (2005)		
Pan-American Health Organization (PAHO)	Biosafety and Laboratory Biosecurity Awareness Workshop - Sao Paulo, Brazil (2005)	<i>Maintenance Manual for Laboratory Equipment</i> (2005)	Course in Quality Management for Laboratories (2005)
	Biosafety and Laboratory Biosecurity Awareness Workshop - Guatemala City, Guatemala (2006)	<i>Biosafety Cabinets: Use, Disinfection, and Maintenance</i> (2005)	
Pedro Kourí Institute			International Course on Biosafety in the Laboratory -Havana, Cuba (2006)
			International Course on Biosafety in the Laboratory -Havana, Cuba (2007)
Universidad Nacional de Río Cuarto, Department of Agriculture and Veterinary Medicine	Biosafety Standards in Diagnostic Laboratories -Argentina (2005)		

APPENDIX VI: Key Regional Events: Middle East

Summary of key Middle Eastern regional laboratory biosecurity and biosafety events during 2003-2008.

Organization	Conferences and Workshops	Publications	Resources
WHO Eastern Mediterranean Regional Office (WHO-EMRO)	Biosafety and Laboratory Biosecurity Awareness Workshop - Teheran, Iran (2006)		
International Council for the Life Sciences (ICLS), The Environment Agency of Abu Dhabi	A Seminar for the Life Sciences and Policy Communities in the Gulf, Middle East and North Africa - Abu Dhabi, United Arab Emirates (2007)		
Interpol	Regional Bioterrorism Prevention Workshop - Muscat, Oman (2007)		
World Federation for Culture Collections (WFCC)	Management of Culture Collections of Microorganisms - Rabat, Morocco (2004)		

APPENDIX VII: Key Regional Events: Russia and the NIS

Summary of key laboratory biosafety and biosecurity events in Russia and the NIS since 2003.

Organization	Conferences and Workshops	Publications	Resources
Canada's Global Partnership Program (GPP)	Canadian Biological Sciences Colloquium - Moscow, Russia (2004)		Establishment of the Central Asian Biosafety and Biosecurity Training Centre at the Kazakh Scientific Centre for Quarantine and Zoonotic Diseases (KSCQZD) in Almaty, Kazakhstan
	Biosafety in High Containment Laboratories - Winnipeg, Canada (2004)		
	Containment Level 3 Facilities: Design and Operation - Ottawa, Ontario (2004)		
Geneva Centre for Security Policy (GCSP), PIR Center	Prospects for International Cooperation in Biosafety, Biosecurity and Biomaterials Control - Moscow, Russia (2005)		
International Advisory Group (IAG) on Biosafety and Biosecurity	1 st Meeting of the International Advisory Group on Biosafety and Biosecurity - Heidelberg, Germany (2007)		
	2 nd Meeting of the IAG on Biosafety and Biosecurity - Moscow, Russia (2007)		
International Council of Life Sciences (ICLS), Canada's GPP, ISTC, Moscow Medical Academy, NP TEMPO	Enhancing Biosafety and Biosecurity: Developing National and International Strategies - Moscow, Russia (2006)		

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International Science and Technology Center (ISTC), Canada's Global Partnership Program (GPP)	Biosafety and Biosecurity Workshop for the Central Asian and Caucasus Regions - Almaty, Kazakhstan (2004)		
Interpol	Interpol Workshop on Preventing Bioterrorism - Kiev, Ukraine		
Landau Network-Centro Volta (LNCV), the Russian American Nuclear Security Advisory Council (RANSAC)	Advancing International Cooperation on Bio-Initiatives in Russia and the CIS - Rome, Italy (2005)		