

Denver 2015: The Interface of Chemical and Biological Sciences International Disarmament Efforts

This full-day presentation explored the efforts made by various stakeholders to eradicate and combat chemical and biological weapons. Discussion topics focused around efforts in public policy, scientific, and public outreach.

POLICY

Chemistry, International Disarmament and Policy in a Technologically Evolving World - Jonathan Forman
(*Organisation for the Prohibition of Chemical Weapons*)

Science and technology directly inform many key articles of international disarmament treaties, ranging from the definitions of classes and categories of weapons, through to the articles that govern mechanisms and verification of compliance, inspection, and assistance and protection. Likewise, treaty negotiation and implementation requires sound technical advice to inform forward looking and robust policy; advice that requires scientific expertise.

Yet, despite the complementary nature of science and policy, these two thematic areas often appear at odds; new scientific developments seen through the eyes of some observers will raise questions about potential misuse and risk to safety and security, while the same research to others may offer solutions to important global problems and present opportunities for peaceful economic development.

Using the experience of the Organisation for the Prohibition of Chemical Weapons (OPCW) and the Chemical Weapons Convention (a multilateral disarmament treaty with one-hundred ninety signatory States), we will review treaty implementation and its scientific underpinning; including how scientific and technological change is viewed and assessed by scientific advisers and policy makers. The chemical weapons convention is particularly relevant in this context as the adoption of biologically inspired methodologies into the chemical industry potentially blurs previously established policy boundaries in disarmament and raises questions on how the underlying scientific developments impact treaty implementation. The presentation will take examples from a recent report of the OPCW's Scientific Advisory Board highlighting convergent trends in the chemical and life sciences that have drawn attention from the disarmament community.

U.S. Department of State's Chemical Security Program: Challenges, successes, and expanding international disarmament/nonproliferation efforts - Dawn Verdugo (*Chemical Security Program, Office of Cooperative Threat Reduction (ISN/CTR), Department of State*)

The U.S. Department of State's Chemical Security Program (CSP) seeks to reduce global chemical threats by implementing projects with partner nations to encourage compliance with, and broader awareness of, relevant chemical nonproliferation and disarmament treaty commitments, U.N. Security Council obligations, and domestic policies that reduce the potential for terrorists to conduct chemical attacks. Specifically, CSP is actively promoting initiatives designed to secure weapons-applicable chemical materials, expertise, and related infrastructure. CSP considers chemical security a collaborative effort and partners with diverse stakeholders,

including governments, technical communities, academics, national and international organizations, in order to craft activities designed to enhance chemical security internationally. A selection of current CSP initiatives including the creation of a chemists' code of ethics in partnership with the ACS, developing international chemical security best practice standards, and the promotion of responsible chemical stewardship throughout technical communities will highlight challenges, successes, lessons learned, and over the horizon opportunities for enhancing global chemical security.

Chemical Issues in Context: The Role of Intent in Nonproliferation and Disarmament Policy - Kabrena Rodda
(*Technology & Policy Integration Specialist, Pacific Northwest National Laboratory*)

Two schools of thought dominate the history of the development and use of chemical warfare (CW). Some say since the advent of nuclear weapons, CW does not present a serious concern – it is nothing more than an annoyance to be dealt with like having to sleep in a tent while deployed. Others, however, subscribe to the opinion that CW represents a significant threat and should not be ignored. An oft-quoted sentiment attributed to Paracelsus puts these two opposed viewpoints in context: “all things are poison and nothing is without poison; only the dose makes a thing not a poison.” It also serves as a cogent reminder of the importance of ascertaining a State's intent to develop chemical warfare agents (CWAs) and, for States that have CWAs, their intent to actually use them. For example, one State may feel merely having CWAs is enough to deter adversaries; another may rationalize using CWAs against its own people for riot control; yet another may successfully deter adversaries by making them believe they have CWAs when they in fact do not. Further complicating characterization of intent is identifying specific compounds that can be used for CW. While the CWC schedule of chemicals provides a starting point, the use of chlorine in Syria and the use of fentanyl against terrorists in Moscow's Dubrovka Theater blur the lines significantly between what does and does not constitute CW. Finally, the need for interagency/international coordination further complicates response efforts and foreign policy formulation. Clearly, when considering intent, one size does not fit all.

This talk will highlight the unique technical and policy challenges associated with international chemical issues, challenging participants to re-think assumptions and promote best practices in coordinating international and interagency activities. Real-world examples will be presented and discussed in the context of the covered concepts.

SCIENCE

Finding the Needle in the Haystack: The Development of Analytical Capabilities at the OPCW and Partner Laboratories In Support Of Verification of the Chemical Weapons Convention - Marc-Michael Blum (*Senior Analytical Chemist, OPCW Laboratory, Organisation for the Prohibition of Chemical Weapons*)

A signature element of the Chemical Weapons Convention (CWC) is the complex and far-reaching verification mechanism that is implemented by the Technical Secretariat of the Organisation for the Prohibition of Chemical Weapons (OPCW). Although a number of verification activities, especially those in the chemical industry, center on checking submitted declarations with records available on-site, the only way to gather factual evidence on the presence (or absence) of chemicals relevant to the CWC is by the use of techniques from the toolkit offered by analytical chemistry.

From the early days after entry into force of the Convention until now these analytical capabilities have grown significantly. This is demonstrated impressively by the raising complexity and difficulty of Proficiency Tests the OPCW runs to designate partner laboratories for off-site analysis of authentic samples. The once dominant GC-MS techniques are now complemented by an ever-increasing use of LC-MS/MS, LC-high-resolution MS, NMR and other techniques. Combined with (micro)synthetic capabilities, this allows structural elucidation of even those chemicals not found in available databases. With respect to biomedical samples the OPCW has run a number of confidence building exercises in which participants have demonstrated their ability to analyze both small molecule metabolites of chemical warfare agents as well as protein adducts at sub ppb concentrations. These capabilities were successfully used in assisting the UN-led mission investigating the use of chemical weapons in Syria and the report containing the results of analysis were submitted by the head of mission to the UN Secretary General and the Security Council.

While the talk will focus to outline the developments that lead to the current state-of-the-art in analytical techniques it will also try to identify trends for the years to come and will point out the deterrent value of an advanced analytical toolset that will make violations of the Convention increasingly difficult to hide

Finding better therapeutics for chemical poisonings: The NIH Countermeasures against Chemical Threats (CounterACT) program - David Jett (*NIH Countermeasures Against Chemical Threats (CounterACT) Program, Office of Translational Research, NIH/NINDS*)

Some chemical exposures can be lethal and cause serious morbidity. The National Institutes of Health (NIH) Countermeasures Against Chemical Threats (CounterACT) program supports research and development projects to find better antidotes and treatments for acute toxic chemical exposures. Some chemicals being studied include chemical warfare agents, toxic industrial chemicals and pesticides, toxins, and other chemicals. A major challenge faced in this effort is the rapid toxic actions of many chemicals, which need to be matched by rapidly acting antidotes and therapeutics. A second challenge is the time and expense of translating basic scientific discovery into approved therapeutics ready for use in humans.

The CounterACT program has addressed these and several other challenges with a network of NIH-funded researchers supported under Research Centers of Excellence, individual research projects, small business grants, contracts, and other programs. The network conducts basic, translational, and clinical research aimed at the discovery and/or identification of better therapeutics. A major strength of the program is that it has engaged some of the best senior researchers in fields such as neurology, pulmonology, and toxicology in order to bring much needed expertise to the problem of treating chemical exposures. The program has contributed greatly to the scientific and technology base, with over 670 research articles in some of the best peer-reviewed journals in science. It has also advanced several products toward regulatory approval including antidotes or therapeutics for nerve agents and pesticides, cyanide, sulfur mustard, chlorine, and others. A program overview and examples will be discussed.

Eradication Techniques for Chemical and Biological Weapons - Richard Holmes (*Project Manager, Bechtel Pueblo Team, Program Executive Office, Assembled Chemical Weapons Alternatives*)

A representative from the Program Executive Office, Assembled Chemical Weapons Alternatives will discuss the organization's methods for destroying chemical weapons.

OUTREACH

Education and outreach relevant to the Organisation for the Prohibition of Chemical Weapons Chemical Weapons Convention - Alejandra Suarez (*Chairperson, Scientific Advisory Board, Organisation for the Prohibition of Chemical Weapons*)

Education and outreach are long term strategic tools for the implementation of the Chemical Weapons Convention (CWC) and the peaceful use of chemistry. The CWC is an international treaty which aims to eliminate an entire category of weapons of mass destruction by prohibiting the development, production, acquisition, stockpiling, retention, transfer or use of chemical weapons. Chemistry is a central science which has done, and will continue to do much good for humanity. It is the essence of our everyday lives and it is important to engage with the public to spread the word on the nature and value of chemistry and chemists' work. Thousands of new chemicals are synthesized every day; which can render enormous benefits for the common good. However, as with any science, there is the possibility that chemistry may be misused as it has been done in the past. For this reason, awareness-raising about the multiple uses of chemical substances and the dual use nature of scientific knowledge is needed at all levels of chemistry education and public outreach programmes.

This presentation will describe the activities and outcomes of the interactions with the participants in the outreach work performed to achieve this goal. Workshops, seminars and events like "The Week of Chemistry" were carried out for public outreach and engagement with university and high school students, policymakers, diplomats, representatives from chemical industry and federal agencies. The achievements of chemistry for the benefit of humankind and the importance of building a culture of responsibility towards the use of chemical substances were the key messages. The award of the Nobel Peace Prize to the OPCW in 2013 provided a paramount opportunity to engage media and public audiences to stimulate the appreciation of chemistry and to increase awareness about the OPCW and the aims of the CWC; this was achieved through newspaper and magazine articles, interviews and radio and television appearances. Education and outreach to future generations to promote the peaceful uses of chemistry is an essential part of achieving our goal of a world free of chemical weapons.

Emerging technologies and diffusion of innovation: Security challenges for the 21st century - Margaret Kosal (*Assistant Professor, Ivan Allen College of Liberal Arts, Georgia Institute of Technology*)

Understanding the changing paradigms and limiting the proliferation of unconventional weapons for the 21st Century starts with an awareness of the factors driving the capabilities, analysis of the changing nature of technological progress, the nature of warfare, and the relationship between science and international security. For scholars of international security, the intersection of science and technology with armed conflicts and military capabilities is a long-standing area of inquiry and are prominent factors in strategic choices, balance of power, deterrence postures, nonproliferation regimes, security doctrines, and programmatic choices. Advances in technology have and are anticipated to further marry the successful characteristics of availability, affordability, mobility, lethality, and durability that drove the proliferation of unconventional and conventional weapons. How will the global expansion in nanotechnology, advanced biotechnology, and the cognitive neurosciences affect the material instability, complexity, and burden of knowledge associated with acquisition and use of unconventional weapons, like biological and chemical agents, by state- and non-state actors?

This talk will explore and probe specific characteristics and operationalizing factors – technical and non-technical – that are likely to impact on the adoption of new technologies by states and by non-state actors. The goal is not to predict new specific technologies but to develop a robust analytical framework for assessing the impact of new technology on national security and identifying measures to prevent or slow proliferation of new technologies for malfeasant intentions. Working at the intersection of strategy, technology, and governance, this work explores the need to and explores understanding of the complex and interdependent relationships among science, technology, and security –

politics, cultures, organizations, institutions, and individuals – in order to explain how these phenomena intersect and potentially impact US and international security policies.

Not in my backyard: Outreach efforts by the Program Executive Office, Assembled Weapons Alternatives (PEO-ACWA) on chemical weapons destruction - Gregory B. Mohrman (*Site Project Manager, Pueblo Chemical Agent-Destruction Pilot Plant, Program Executive Office, Assembled Chemical Weapons Alternatives*)

A representative from the Program Executive Office, Assembled Chemical Weapons Alternatives will discuss the agency's public outreach efforts.