OPCW Scientific Advisory Board Briefing to States Parties

Christopher M Timperley SAB Chair
Cheng Tang SAB Vice-Chair

Thursday, 30 March 2017
Ieper Room | 13.30-15.00
Light lunch available at 13.00
TODAY’S OPCW

Today, the Chemical Weapons Convention is the most successful international disarmament treaty eliminating an entire class of weapons of mass destruction. The commitment to the Convention by 192 nations — representing 98 per cent of the world’s population — is meant for the benefit of people and the planet.
Reports of the Scientific Advisory Board
SAB-23/1, dated 22 April 2016
SAB-24/1, dated 28 October 2016

Director-General’s Response to Reports of the Scientific Advisory Board
EC-82/DG.13, dated 7 June 2016 (SAB-23)
EC-84/DG.9, dated 18 January 2017 (SAB-24)

Response to the Director-General’s Request to the Scientific Advisory Board to Provide Further Advice on Scheduled Chemicals
(SAB-23/WP.1, dated 28 April 2016)

Response to the Director-General’s Request to the Scientific Advisory Board to Provide Further Advice on Chemical Weapons Sample Stability and Storage
(SAB-23/WP.2, dated 25 May 2016)

Report of the Scientific Advisory Board’s Workshop on Chemical Forensics
(SAB-24/WP.1, dated 14 July 2016)

Report of the Scientific Advisory Board’s workshop on Chemical Warfare Agent Toxicity, Emergency Response and Medical Countermeasures
(SAB-24/WP.2, dated 14 October 2016)

Briefing to the 21st Conference of the States Parties, December 2016:

Statement  Slides  To Learn more about the SAB
NOTE BY THE DIRECTOR-GENERAL

RESPONSE TO THE REPORT OF THE TWENTY-FOURTH SESSION OF THE SCIENTIFIC ADVISORY BOARD

1. This Note sets out the Director-General’s comments on the report of the Twenty-Fourth Session of the Scientific Advisory Board (SAB) (SAB-24/1, dated 28 October 2016) and the ongoing work of the SAB.

2. An understanding of developments in science and technology is crucial to the full and effective implementation of the Chemical Weapons Convention (hereinafter “the Convention”), as scientific and technological underpinnings are found throughout its articles. The rapid pace of scientific advances, alongside increased diffusion and globalisation of scientific knowledge, demands scientific literacy and the ability to bring practical scientific advice to policymakers.

3. With the preparation of the SAB’s recommendations to the Fourth Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention (hereinafter “the Fourth Review Conference”), the activities of the SAB have seen a significant increase, as illustrated by the six substantive reports produced in 2016.¹ The Director-General encourages States Parties to carefully consider his call for voluntary contributions (S/1459/2017, dated 16 January 2017) to support the work of the SAB. In this regard, the Director-General wishes to thank the Government of New Zealand for its 2016 contribution.

4. The Director-General wishes to inform States Parties that seven members of the SAB will be leaving the Board in 2017 and a formal call for nominations has been issued (S/1452/2017, dated 18 January 2017). States Parties wishing to submit nominations to the SAB must do so by 28 July 2017.

RESPONSE TO THE REPORT OF THE TWENTY-FOURTH SESSION OF THE SCIENTIFIC ADVISORY BOARD

5. The SAB met in The Hague, the Netherlands, for its Twenty-Fourth Session from 25 to 28 October 2016. The session was chaired by Dr Christopher Timperley, with Mr Cheng Tang as the Vice-Chairperson. The report of the session was issued as SAB-24/1.

¹ Reports of the SAB are available at: www.opcw.org/about-opcw/subsidiary-bodies/scientific-advisory-board/documents/reports/
Science, Disarmament, and Diplomacy in Chemical Education: The Example of the Organisation for the Prohibition of Chemical Weapons

http://confchem.ccce.divched.org/2016SpringConfChem

Endorsed by ACS CHED CCCE
Science, disarmament and diplomacy in chemical education: the example of chemical weapons – The Spring 2016 Confchem

Robert E. Belford* and Jonathan F. Forman

Abstract

The OPCW is an international organisation for the prohibition of chemical weapons (OPCW). Its primary objective is to implement the Chemical Weapons Convention (CWC) with the aim of eliminating the use of chemical weapons as weapons of war. The OPCW monitors and records all use of chemicals in armed conflicts and provides technical assistance to States Parties to the CWC. The OPCW also provides technical assistance to States Parties to the CWC in the development of national legislation to implement the CWC and in the implementation of the CWC.

This paper describes how the OPCW is using chemical weapons in armed conflicts and how it is assisting States Parties to the CWC in the development of national legislation to implement the CWC. It also describes how the OPCW is providing technical assistance to States Parties to the CWC in the implementation of the CWC.

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Spiez Laboratory & OPCW Present Science for Diplomats at CSP-21

Wednesday 30 November 2016
Europe Room, World Forum
13:00 – 15:00

A Review of three workshops: Spiez CONVERGENCE 2, and the OPCW SAB’s Chemical Forensics and Toxicity of Chemical Agents; with lunch
Spiez Laboratory & OPCW Present Science for Diplomats at CSP-21
Science Advice at the OPCW
A Side-Event of the 8th Review Conference of the BWC

Thursday
10 November 2016
13:00-15:00
Room XXV
Science Advice at the OPCW
A Side-Event of the 8th Review Conference of the BWC

Science Advice and Policy-Maker Engagement in Support of the Chemical Weapons Convention
Dr Jonathan Forman, OPCW Science Policy Adviser and Secretary to the Scientific Advisory Board

The OPCW Scientific Advisory Board
Dr Christopher Timperley, OPCW Scientific Advisory Board Chair

The Role of Designated Laboratories
Professor Paula Vanninen, OPCW Scientific Advisory Board

Science Advice on Medical Countermeasure Aspects Against Chemical Warfare Agents
Dr Zrinka Kovarik, OPCW Scientific Advisory Board

The Hague Ethical Guidelines: Applying the norms of the practice of chemistry to support the Chemical Weapons Convention
Mr Cheng Tang, OPCW Scientific Advisory Board Vice-Chair
Four new SAB members
Overview of developments at OPCW

- OPCW Chemical Demil. Branch provided a briefing on Libya’s Category 2 chemicals - removal and destructions operations - and an update on Iraq

- OPCW Office of Strategy and Policy updated the SAB on the status of the work of the Open Ended Working Group on Future Priorities of the OPCW
The International Union of Pure and Applied Chemistry is the global organization that provides objective scientific expertise and develops the essential tools for the application and communication of chemical knowledge for the benefit of humankind and the world.
IUPAC’s role in chemistry community

• A focus on those aspects of chemistry where global consensus is essential for progress in research, commerce and policy.

• Respect for its objectivity and scientific excellence, providing access to the highest levels in the scientific, industrial, and policy communities to represent global chemistry.

• A worldwide base of volunteers with the best skills and background, recruited by transparent and well-understood processes.
IUPAC and SAB future collaboration
Francois van Straten (SAB, South Africa) talked about nanotechnology from CWC perspective

Scientific advances since Third CWC Rev. Con. have resulted in advances in:

- Analysis of CW agents
- Detection of toxic chemicals
- Decontamination techniques
Valentin Rubaylo (SAB, Russia) gave a presentation on nanomaterials and their potential toxic hazards.

Some limited studies describing the toxicity of nanomaterials in animals exist, but difficult to conclude from these that the materials would be toxic to humans by inhalation or skin contact.
Nanomedicine

Briefing by Prof. Andrew Wang of University of North Carolina

Novel medicines based on nanoparticles (less than or equal to 100 nm in diameter)

Nano size can impart unique properties and be used for the delivery of therapeutic agents

Research in this area continues

Nanocatalysis

- Briefing by Mongia Said Zina (SAB, Tunisia) gave a briefing on catalysis by nanomaterials for environmental protection.

- Nanomaterials are increasingly used as catalysts for chemical production: their structure is ordered with large surface area.

- Improved catalysts can result in greener chemical processes.
Scientific and technological elements of verification technologies
Toxin analysis

Dr. Brigitte Dorner (Robert Koch Institute, Germany) provided a presentation on detection and identification technologies for biological toxins

Analytical options for ricin:
- Immunological methods
- Spectrometric identification
- Functional methods

Best to use a combination of these analytical techniques
Dr. Stuart Thompson (OPCW Laboratory) informed the SAB about this exercise and results:

26 laboratories nominated from 19 member states; 24 reports received by OPCW.

Laboratories used different methods in combination and for many of these methods improvements in sensitivity are desirable and are being sought.
Chemical and biological forensics

Forensics and source attribution of chem-bio threat agent attacks

Jon Ahlinder
CBRN division, Swedish Defense Research Agency (FOI), Umeå, Sweden
Project Underworld

Presentation by Prof. Eric Alm, Massachusetts Institute of Technology
Levinstein sulfur mustard

Dr. Marc-Michael Blum (OPCW Laboratory) described how computational chemistry and analytical chemistry could be used to determine the route of production of sulfur mustard.

Sulfur mustard made by the Levinstein route contains specific polysulfur impurities.

Calculations help understand how these by-products form.
Inspectorate training

General information about the CWA, CWC, and OPCW

Capability to work in a toxic environment

Briefing from Mehran Rouzbahani

Speciality Training:
- Chemical Production Technologist
- Chemical Weapons-Munition Specialist
- Analytical Chemist
- Health and Safety Specialist

Contingency Operations
- SSAFE training;
- Contingency Operation Exercise
- Command and Control
- Interview Skills
- Forensics
- Communication
The CTBT Verification Regime

GLOBAL COMMUNICATIONS INFRASTRUCTURE

INTERNATIONAL DATA CENTRE

INTERNATIONAL MONITORING SYSTEM

5 Geostationary Satellites

Radionuclide (80, 1/2 Xe)

Seismic (50 Pri + 120 Aux)

Infrasound (60)

Hydroacoustic (6 hydro, 5T)

Presentation to SAB by Patrick Grenard, CTBTO
CTBTO International Monitoring

PS01 Paso Flores, Argentina
Visit to Shell Pernis chemical plant
Medical countermeasures

International workshop on chemical warfare agents: toxicity, emergency response and medical countermeasures

Maison de la chimie – Paris
September 26-27, 2016

Co-organized by the General Secretariat for Defense and National Security and the Organization for Prohibition of Chemical Weapons

1. EXECUTIVE SUMMARY

1.1 The Organisation for the Prohibition of Chemical Weapons (OPCW) Scientific Advisory Board (SAB) in cooperation with the Secretariat General de la Défense et de la Sécurité Nationale (SGDSN) held a workshop on “Chemical Warfare Agents: Toxicity, Emergency Response and Medical Countermeasures” from 26 to 27 September 2016 in Paris, France. The workshop was the second in a series intended to inform the report of the SAB on developments in science and technology to the Fourth Review Conference of the Chemical Weapons Convention, which is to be held in 2018.

1.2 Effective emergency response and medical treatment form a frontline defence against the use of chemical agents. The more effective detection and alarm systems, protective equipment, decontamination equipment, medical antidotes and treatments become, the less effective are chemical weapons. Staying abreast of developments in science and technology related to the toxicology of chemical warfare agents (CWAs), clinical detection of exposure and medical response (both short- and long-term) is of vital importance. This importance is underscored by current events in the Syrian Arab Republic and growing concerns over the potential for the use of chemicals by terrorists. In this regard, understanding the molecular biological mechanisms and the chemistry through which chemical agents exert their toxic effects is critical for the development of more effective medical countermeasures and for the long-term treatment of survivors of exposure.

1.3 This workshop brought together experts from relevant scientific fields and stakeholders in chemical security to discuss and review current knowledge and
Medical countermeasures

Presentation by Prof. Mohammad Abdollahi (SAB, Iran) on gene therapy for treating sulfur mustard poisoning

Delayed toxicity treatment

**Skin:**
- Systemic antihistamine
- Local emollients
- Frequent baths
- Sunscreen lotion and cream

**Respiratory system:**
- Beclomethasone inhaler
- Bronchodilator (salbutamol + ipratropium)

**Supportive care**
focuses on the prevention of infection and reduction of pain.

**Eye:**
- Artificial tears
- Therapeutic contact lenses
- Local/systemic corticosteroid
- Immunosuppressant (e.g. azathioprine)
- Corneal argon laser
- Keratoplasty
Advice on riot control agents

NOTE BY THE TECHNICAL SECRETARIAT

DECLARATION OF RIOT CONTROL AGENTS: ADVICE FROM THE SCIENTIFIC ADVISORY BOARD

1. In accordance with subparagraph 1(e) of Article III of the Chemical Weapons Convention (hereinafter “the Convention”), States Parties are required to declare riot control agents (RCAs), which are defined in paragraph 7 of Article II of the Convention.

2. At its Twentieth Session, the Scientific Advisory Board (SAB) was requested by the Director-General (Annex 4 of SAB-20/1, dated 14 June 2013) to provide technical advice on an initial list of RCAs that had been declared by States Parties, researched, or were commercially available.

3. The SAB has advised the Director-General that the following 17 chemicals correspond to an RCA as defined by paragraph 7 of Article II of the Convention:
Science for Diplomats at EC-84
What Defines a Riot Control Agent?

Come activate your TRP receptors and learn about the biochemistry of Riot Control Agents!

Wednesday, 8 March 2017
Ooms Room | 13.30-14.45
Light lunch available at 13.00
A Visual Guide to Science & Technology

Alyl isothiocyanate
responsible for wasabi's spicy attitude

COUNTERMEASURES

Water
Vanilla Ice cream
Riot Control Agents
Fauzia Nurul Izzati, Jonathan E. Forman and Christopher M. Timperley

What is the definition of a Riot Control Agent (RCA)?
From paragraph 7, Article II of the Chemical Weapons Convention:
"Any chemical not listed in a Schedule, which can produce rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination of exposure."

How do Riot Control Agents work?
RCAs produce irritation through binding to receptors, primarily located on cell membranes of multicellular organisms. TRP receptors are classified into subtypes: TRPC (canonical or classical), TRPV (vanilloid), TRPM (melastatin), TRPA (ANKT-like), TRPP (polycystin), TRPML (mucolipin), and TRPN (NOMPC) subfamilies.

What are Riot Control Agents?
Chemicals that meet the criteria of an RCA include the following:

- 2-Chloroacetanilide (2-CA)
  - Synonyms: 2-Chloroacetanilide, 2-chloroacetanilide, 2-Chloroacetanilide, 2-Chloroacetanilide, 2-Chloroacetanilide.
  - Physical state: White solid, melting point 133-135°C.

- 3-Chloroacetanilide (3-CA)
  - Synonyms: 3-Chloroacetanilide, 3-Chloroacetanilide, 3-Chloroacetanilide, 3-Chloroacetanilide, 3-Chloroacetanilide.
  - Physical state: White solid, melting point 133-135°C.

- 8-Methyl-N-vanillyl-3-nonenamide
  - Synonyms: 8-Methyl-N-vanillyl-3-nonenamide, 8-Methyl-N-vanillyl-3-nonenamide, 8-Methyl-N-vanillyl-3-nonenamide, 8-Methyl-N-vanillyl-3-nonenamide, 8-Methyl-N-vanillyl-3-nonenamide.
  - Physical state: White solid, melting point 133-135°C.

What are TRP Receptors?
TRP receptors are ion channel receptors, mainly located on cell membranes of multicellular organisms to detect chemical and mechanical stimuli. They are divided into four major subfamilies: TRPC (canonical or classical), TRPV (vanilloid), TRPM (melastatin), and TRPA (ANKT-like). TRPP (polycystin), TRPML (mucolipin), and TRPN (NOMPC) subfamilies.

Important functions of TRP receptors include: serving as versatile sensors that allow individual cells and organisms to detect chemical and mechanical stimuli in their environment. This includes experiencing changes in temperature, touch, taste and other stimuli (including pain).

Capsaicin, homocapsaicin, and other related compounds bind to the TRPV1 receptor. These chemicals are naturally found in hot chili peppers.
Painful chemistry! From barbecue smoke to riot control

Christopher Green¹ / Farrha B. Hopkins¹ / Christopher D. Lindsay¹ / James R. Riches¹ / Christopher M. Timperley¹

¹ Defence Science and Technology Laboratory (DSTL), Porton Down, Salisbury, Wiltshire SP4 0JQ, United Kingdom of Great Britain and Northern Ireland

Article note:
A collection of invited papers based on presentations at the Open Access Online Conference “Science, Disarmament, and Diplomacy in Chemical Education: The Example of the Organisation for the Prohibition of Chemical Weapons”, which was held from 2nd May till 20th June 2016.

Citation Information: Pure and Applied Chemistry. 20160911, ISSN (Online) 1365-3075, ISSN (Print) 0033-4545, DOI: https://doi.org/10.1515/pac-2016-0911. November 2016
Workshop on innovative technologies
Innovative technologies programme

Recognition of biochemical change

- If plants could talk
- Large area monitoring
- Chemical sensing

Mobile wearable point-of-care devices for collecting data

Taking samples in remote and hazardous environments
Workshop on chemical production
Chemical production programme

Aim to examine trends in all sectors of the chemical industry

- Chemical economy
- Commodity chemicals
- Pharmaceuticals
- Fine/speciality chemicals
- Custom automated synthesis
- Biologicals
- Agricultural chemicals
- Regulatory issues
Chemical forensics

OPCW

Scientific Advisory Board

REPORT OF THE SCIENTIFIC ADVISORY BOARD’S WORKSHOP ON CHEMICAL FORENSICS

1. EXECUTIVE SUMMARY

1.1 The OPCW Scientific Advisory Board (SAB) in cooperation with VERIFEN held a workshop, “Chemical Forensics: Capabilities across the Field and the Potential Applications in Chemical Weapons Convention Implementation”, from 20 to 22 June 2016 in Helsinki, Finland. The workshop is one of a series intended to inform the report of the SAB on developments in science and technology to the Fourth Review Conference of the Chemical Weapons Convention to be held in 2018. Interest in chemical forensics, and its relevance to the work of the OPCW, has been described through Recommendation 17 of the OPCW SAB’s Temporary Working group on Verification.

1.2 Forensic science is defined as the study of traces (remnants of presence and/or activity). These are silent witnesses that need to be detected, seen, and understood to make reasonable inferences about criminal phenomena, investigation, or demonstration for intelligence, investigation, and court purposes.

1.3 Chemical forensics aims to obtain information from chemical remnants that is relevant to investigative, legal, and intelligence questions. Just as fingerprints and DNA can provide unique signatures that can be used to identify individuals, chemical samples can provide distinctive signatures (for example through their impurities...

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1. Funding for the workshop was provided in part through project III (Science and Technology: Assessment of Developments in Science and Technology) of EU Council Decision (CFSP) 2015/235 dated 17 February 2015. [Link to project]
5. C. Renk, F. Cipriano, O. Rolon; Current Issues in Criminal Justice, 2012, 24(1), 7-24. [Link to article].
TWG on investigative studies
NOTE BY THE DIRECTOR-GENERAL

RESPONSE TO THE REPORT OF THE TWENTY-FOURTH SESSION OF THE SCIENTIFIC ADVISORY BOARD

In accordance with paragraph 9 of the SAB’s terms of reference (C-II/DEC.10/Rev.1, dated 2 December 2004), the Director-General requests that the SAB establish a new temporary working group (TWG) and appoint a Chairperson for it. This TWG will address questions relating to science and technology relevant in investigative work, and will undertake further consideration of topics described in paragraph 8 above, other recommendations from the chemical forensics workshop, and in particular questions falling under subparagraphs 2(e) and (g) of the SAB’s terms of reference relevant to investigative methods in contingency operations. The Director-General will in the near future prepare a mandate for the TWG, which should hold its first meeting before the end of the first quarter of 2018.
Terms of reference

To review S&T relevant to investigative work, especially for the validation and provenancing (determining the chronology of ownership, custody and/or location) of evidence, and the integration of multiple and diverse inputs to reconstruct a past event.
Questions (a – i)

- Which methods and capabilities used in the forensic sciences could usefully be developed and/or adopted for Chemical Weapons Convention-based investigations?

- What are the best practices and analysis tools used in the forensic sciences for effectively cross-referencing, validating, and linking together information related to investigation sites, materials collected/analysed and individuals interviewed?

- What are the best practices for management of data collected in investigations, including compilation, curation, and analytics?

- What are the best practices for the collection, handling, curation and storage, and annotation of evidence?

- Which technologies and methodologies (whether established or new) allow point-of-care and non-destructive measurements at an investigation site to help guide evidence collection?

- Which technologies and methodologies (whether established or new) can be used in provenancing of chemical and/or material samples collected in an investigation?

- Which methods are available (or are being developed) for the sampling and analysis of environmental and biomedical materials that can be used in the detection of toxic industrial chemicals relevant to the Convention?

- Which technologies and methodologies (whether established or new) can be used in provenancing of chemical and/or material samples collected in an investigation?

- Which technologies and methodologies (whether established or new) can be used in ensuring chain of custody and verifying authenticity (especially in regard to digital images and video recordings)?
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Questions (i and k)

Which technologies and methodologies (whether established or new) can be used to ensure the integrity of an investigation site?

Do collections of physical objects, samples and other information for chemical weapons relevant analysis exist that can be made available to investigators for retrospective review? And how might these collections be used to support investigations?

Are there stakeholders that the Technical Secretariat could usefully engage with, to leverage their capabilities on investigative matters?

Medium Term Plan: Result Area 3

- **Medium-term goal 8:** Augmented the Organisation’s efforts to reach universality
- **Medium-term goal 9:** Enhanced and sustainable collaboration with other international organisations
- **Medium-term goal 10:** Strengthened engagement with broader group of relevant stakeholders
- Engagement to leverage others’ capabilities
Guidance for Technical Secretariat

In addition, the TWG will provide advice on Secretariat proposals for methodologies, procedures, technologies, and equipment for investigative purposes.
Dr Veronica Borrett (SAB, Australia) appointed as the Chairperson of the TWG by election by the SAB

Recommend membership

The TWG will consist of individuals who collectively have expertise in theory and practice of investigative work; including but not limited to investigational chemical analysis, evidence collection, forensic sciences, informatics, crime scene reconstruction, toxicology, inspection or experience of implementation of the Chemical Weapons Convention

6-8 SAB members (including Chair) and 8-10 other experts
TWG history

- 1999-2000  Chemical weapons destruction technologies
- 1999-2000  Equipment issues
- 1999-2000  Analytical procedures
- 1999-1999  Ricin production
- 1999-1999  Adamsite
- 2000-2000  Low conc limits (Schedule 2A & 2A* chemicals)
- 2004-2007  Biomedical samples
- 2007-2012  Sampling and analysis
- 2011-2013  Convergence of chemistry and biology
- 2012-2014  Education and outreach
- 2013-2015  Verification
- 2018-2020  Investigative science and technology
TWG reports

CONVERGENCE OF CHEMISTRY AND BIOLOGY
REPORT OF THE SCIENTIFIC ADVISORY BOARD'S TEMPORARY WORKING GROUP
JUNE 2014

EDUCATION AND ENGAGEMENT:
Promoting a Culture of Responsible Chemistry

FINAL REPORT OF THE SCIENTIFIC ADVISORY BOARD'S TEMPORARY WORKING GROUP
NOVEMBER 2014

VERIFICATION
REPORT OF THE SCIENTIFIC ADVISORY BOARD'S TEMPORARY WORKING GROUP
June 2015
ACS recognises that ‘given recent and ongoing reports of incidents involving CW agents and other weaponized toxic chemicals, there is a pressing need for an effective chemical forensics capability in order to help identify and prosecute perpetrators of chemical attacks’

- The ACS Division of Analytical Chemistry, and ACS Chemistry and Law Division, are holding a two day symposium to review developments and topics arising in chemical forensics on 3-4 April 2017
Future SAB diary and work plan

- 2-7 April: ACS Chemical forensics (San Francisco)
- 26 April: OPCW 20 (ceremony at the Ridderzaal)
- First week in October (TBC) : SAB International Workshop on Industrial Technology, Zagreb, Croatia
- 16-20 October : SAB-26 meeting (OPCW, The Hague)
IEPER DECLARATION

HEEDING THE LESSONS OF HISTORY

IN REMEMBRANCE
ENSURING AN ETHOS OF SCIENCE FOR PEACE

THE HAGUE ETHICAL GUIDELINES

To promote a culture of responsible conduct in the chemical sciences and to guard against the misuse of chemistry, a group of chemical practitioners from around the world formulate a set of ethical guidelines informed by the CWC.