

OPCW Scientific Advisory Board Briefing to States Parties



OPCW

1997-**20**17
YEARS

Thursday, 19 October 2017
Ieper Room | 13:30-15:00
Light lunch served at 13:00

Dr Christopher Timperley (SAB Chair) and Mr Cheng Tang (SAB Vice-Chair)



OPCW

1997-2017

YEARS



Successes of the Chemical Weapon Convention

192

NATIONS COMMITTED TO THE
CHEMICAL WEAPONS
CONVENTION

98

PERCENT OF WORLD
POPULATION LIVING UNDER
THE PROTECTION OF THE
CHEMICAL WEAPONS
CONVENTION

95

PERCENT OF WORLD'S
DECLARED CHEMICAL WEAPON
STOCKPILES VERIFIABLY
DESTROYED
(APPROXIMATE)

2017

MAJOR CHEMICAL WEAPONS ZERO MILESTONE:

95 PER CENT OF CHEMICAL WEAPONS
DECLARED BY POSSESSOR STATES
DESTROYED

Photo: U.S. Army





OPCW

Executive Council

Eighty-Fifth Session
11 – 14 July 2017

EC-85/DG.8
19 May 2017
Original: ENGLISH

**NOTE BY THE DIRECTOR-GENERAL
THE IMPACT OF THE DEVELOPMENTS IN SCIENCE AND TECHNOLOGY
IN THE CONTEXT OF THE CHEMICAL WEAPONS CONVENTION**

1. This Note sets out the Director-General's views on the impact of developments in science and technology in the context of the Chemical Weapons Convention (hereinafter "the Convention") and includes comments on the report of the Twenty-Fifth Session of the Scientific Advisory Board (SAB) (SAB-25/1*, dated 31 March 2017).
2. An understanding of developments in science and technology is crucial to the full and effective implementation of the Convention, as scientific and technological underpinnings are found throughout its articles. The need for sound scientific expertise in chemical disarmament has never been greater, as exemplified by the work of the designated laboratories and the needs of the Technical Secretariat's (hereinafter "the Secretariat") contingency operations. Effectively preventing the re-emergence of chemical weapons and ensuring that the Organisation maintains its scientific literacy requires ever greater levels of science policymaker partnerships. In this regard, the SAB serves as a most valuable resource to bring practical scientific advice to policymakers.
3. As the SAB prepares its report and 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"), its workload has seen a significant increase along with consumption of funds available through the SAB trust fund. A call for voluntary contributions to support the work of the SAB was issued in January this year (S/1450/2017, dated 16 January 2017). The Director-General encourages States Parties to carefully consider this Note.
4. The Director-General would like to remind States Parties that seven members of the SAB will be leaving the Board in 2017, three in August and four at the end of the year. A formal call for nominations has been issued (S/1452/2017, dated 18 January 2017) with the deadline for submission of nominations set at 28 July 2017.
5. The SAB met in The Hague, the Netherlands, for its Twenty-Fifth Session from 26 to 30 March 2017. The session was chaired by Dr Christopher Timperley, with

CS-2017-0334(E) distributed 19/05/2017

**RESPONSE TO THE REPORT OF THE TWENTY-FIFTH SESSION OF THE
SCIENTIFIC ADVISORY BOARD**



Key points from Director-General's response

- **Engagement to inform inputs to SAB reports**
 - Technical Secretariat
 - Scientific communities
 - Other scientific advisory mechanisms
 - Other relevant disarmament forums
- **Scientific review process**
 - Forward looking advice
 - Practical advice
 - Understanding driving forces and trans-disciplinary nature of new developments
- **Encourages States Parties to review RCA report**
 - Detailed resource to accompany 2014 S-Note
 - Publication in peer-reviewed scientific literature





The National
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SCIENCES
ENGINEERING
MEDICINE



International Workshop on Innovative Technologies for Chemical Security

03-05 | JULY - 2017
RIO DE JANEIRO - BRAZIL

INTERNATIONAL WORKSHOP ON INNOVATIVE TECHNOLOGIES FOR CHEMICAL SECURITY

Science for Peace



Thematic content

Emerging technologies and the implementation of the CWC

Recognizing biochemical change:

if plants could talk

large scale environmental monitoring

chemical sensing



Mobile and wearable technologies and point-of-care device

Digital health

Collecting data in remote and dangerous environments

International monitoring networks

Computer aided engineering tools applied to CWC

Contingency operations and challenges

Starting with the 2013 UN-led mission to the Syrian Arab Republic, the TS has undertaken non-routine inspection, verification and technical assistance activities in Syria, Libya and Iraq

These contingency operations have required investigations, analysis, and fact-finding, with collection and evaluation of oral, material, and digital evidence of the use of toxic chemicals



Contingency operations and challenges

Non-routine situations in which these operations have occurred are insightful for consideration of new technologies with potential to enhance capabilities available to inspectors

Access to sites is time-limited; harsh environmental conditions; requirement for chain-of-custody, care required while obtaining and shipping samples; evidence needs authenticating, and requires expertise extending beyond chemical analysis



VERIFICATION

REPORT OF THE SCIENTIFIC ADVISORY BOARD'S TEMPORARY WORKING GROUP

June 2015



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Outcomes

A broad set of technology exists that can potentially find application in some areas of implementation of the CWC. In general, such tools appear best suited toward non-routine (contingency) and/or assistance and protection operations, investigations, enhancement of laboratory capabilities, and stakeholder engagement.

Technologies that integrate informatics tools, mobile devices and remote sensing with an expanding range of capabilities are becoming increasingly accessible. The Convention's science review process should continue to keep abreast of developments in these areas.

Outcomes

A number of the technologies considered during the workshop have potential for reducing the risks to personnel operating in dangerous environments. Further consideration of these technologies could assist with development of recommended best practices for operating under such conditions.

Many interesting and potentially enabling technologies were discussed. Their suitability for field use requires field testing to meet operational requirements (and fit within mission specific goals).

Opportunities to engage with technology developers and evaluate new tools should be encouraged.

OPCW Press Release

7 July 2017

Brazil Academy of Science

<http://www.abc.org.br/centenario/?Ciencia-para-a-paz>



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

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Jobs / Interns

Organisation for the Prohibition of Chemical Weapons / News

News by topic

- Disarmament
- Non-proliferation of chemical weapons
- Assistance and Protection
- International Cooperation
- National implementation
- Universality
- Outreach
- OPCW and the UN

Scientists Review Innovative Technologies for Chemical Security

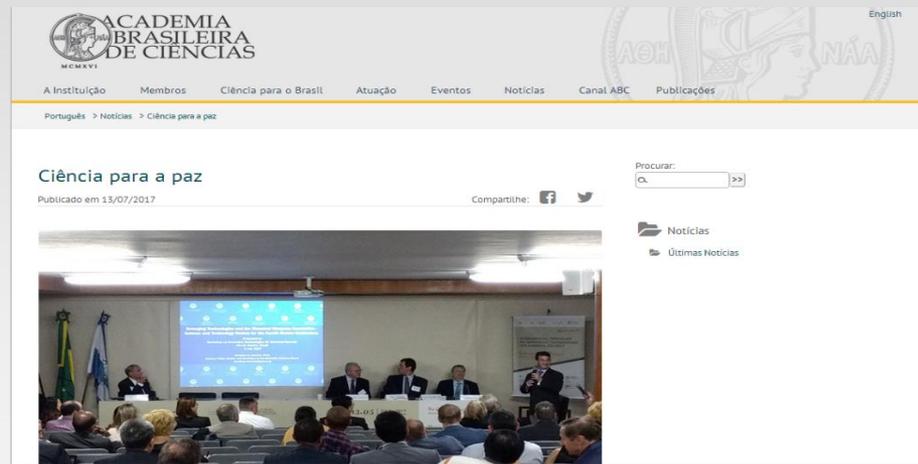
Friday, 07 July 2017

THE HAGUE, Netherlands — 7 July 2017 — The Scientific Advisory Board (SAB) of the Organisation for the Prohibition of Chemical Weapons (OPCW) discussed the potential uses innovative scientific and technological tools in the implementation of the Chemical Weapons Convention (CWC) at a workshop “Innovative Technologies for Chemical Security”, held from 3 to 5 July in Rio de Janeiro, Brazil.

Participants at a workshop on innovative technologies for chemical security in Rio de Janeiro

The event was organised in cooperation with the International Union of Pure and Applied Chemistry (IUPAC), the National Academies of Science, Engineering and Medicine of the United States of America (NAS), the Brazilian Academy of Sciences and the Brazilian Chemical Society.

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Últimas Notícias



Science for Diplomats at EC-86

Innovation

and

the Chemical Weapons Convention:

The **S**cientific **A**dvisory **B**oard's Report on
Emerging Technologies



Tuesday, 10 October 2017

Ooms Room 13:30-14:45

LIGHT LUNCH AVAILABLE AT 13:00



OPCW

1997-**2017**
YEARS





DANGER



ORGANISATION FOR THE
PROHIBITION OF CHEMICAL WEAPONS

Working together for a world free of chemical weapons

International Workshop Trends in Chemical Production

3-5 October 2017, Zagreb, Croatia



Institut za
medicinska
istraživanja
i medicinu
rada

Institute
for Medical
Research and
Occupational
Health



Trends in chemical production



Examine trends in all sectors of the chemical industry

- **Chemical economy**
- **Commodity chemicals**
- **Pharmaceuticals**
- **Fine/speciality chemicals**
- **Custom automated synthesis**
- **Proteins and nucleic acids**
- **Agricultural chemicals**
- **Regulatory issues**

Outcomes

As technological advances related to the discovery and production of chemicals are adopted, a fit-for-purpose verification regime should maintain up to date operational knowledge of chemical (and biological) production methods (including aspects of synthesis and analysis).

Recognizing unusual processes or aspects of a laboratory or production facility that are inconsistent with allowable activities under the Convention is valuable for both prevention of re-emergence and post-event fact-finding.

Training exercises and proficiency testing could usefully take into account such considerations.

Outcomes

The workshop served as a reminder of the highly trans-disciplinary (convergent) nature of 21st century technology development, with scientific disciplinary convergence going well beyond the fields of chemistry and biology.

This observation supports the view that the scientific review process must engage broad scientific communities and look for opportunity in technological change to ensure that implementation of the Convention remains fit-for-purpose.

Sharing of experience on science advice with other relevant disarmament communities (especially the Biological Weapons Convention stakeholders) should be encouraged.



Reports of the Scientific Advisory Board

SAB-23/1, dated 22 April 2016

SAB-24/1, dated 28 October 2016

SAB-23



SAB-24



EC-82



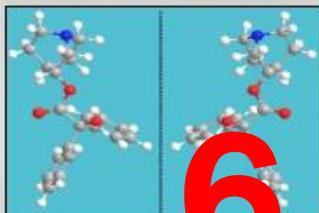
EC-84



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)



6 Reports in 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)



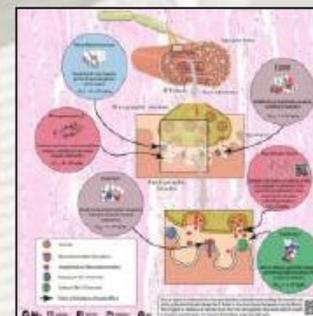
Report of the Scientific Advisory Board's Workshop on Chemical Forensics

(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

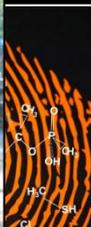


Slides



To Learn more about the SAB

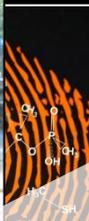




03-05 JULY - 2017
 INTERNATIONAL WORKSHOP
 ON INNOVATIVE TECHNOLOGIES
 FOR CHEMICAL SECURITY
Science for Peace
 #ScienceforPeace



The board
 Final board
 The Director



Attendance: 187 experts
- 159 individuals
- 40 nationalities

Speakers: 111
- 91 individuals
- 31 nationalities



SAB-26



Developments at OPCW

Open-Ended Working Group on Future Priorities

“Evolution of the verification regime” (Feb 2017)



Most noted topics and issue areas:

- Risk based/holistic approach to verification
- Strengthening analytical capabilities of TS and Lab
- Additions to OCAD
- Increasing number of designated laboratories
- Need to keep up with S&T advances
- Tenure policy/knowledge management

Developments at the OPCW

Countering chemical terrorism

Open-Ended Working Group on Terrorism
Sub-Working Group on Non-State Actors



EC-86/DEC.9 of 13 October 2017, addressing non-state actors:

Requests the Director-General (DG) to provide technical assistance within the DG's mandate, in accordance with the Convention, in connection with the CW use by a non-state actor

Developments at the OPCW

Advisory Board on Education and Outreach

Knowledge management update

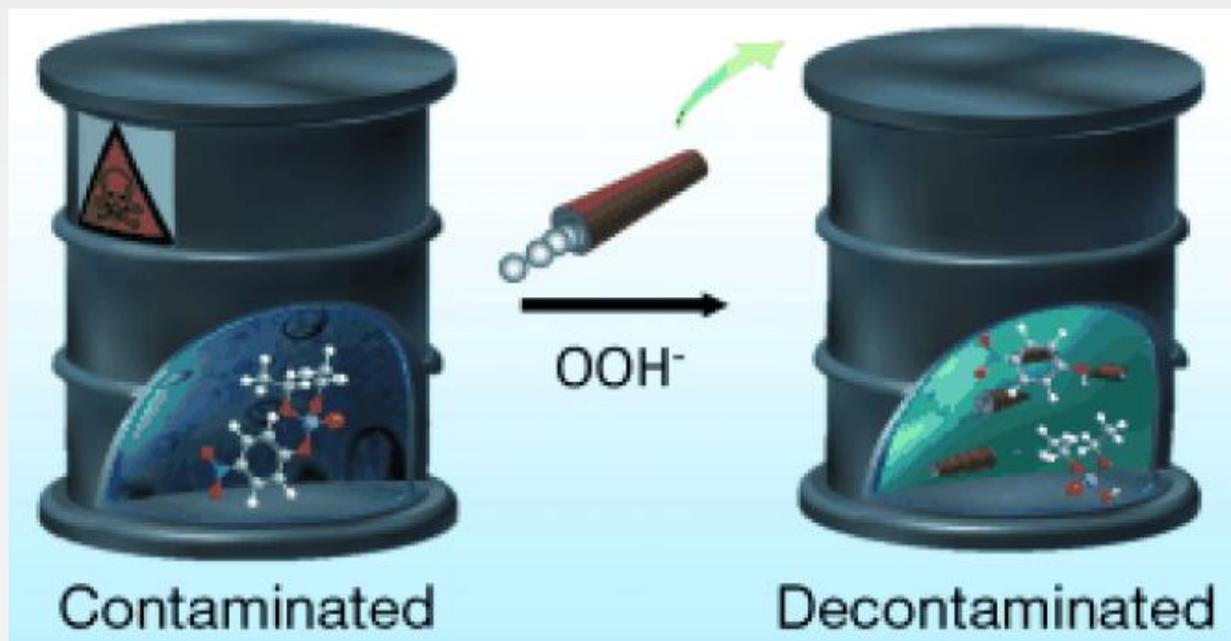
Verification

- OPCW Fact-Finding Mission
- Report of workshop on chlorine
- On-site sampling and analysis
- Training/preparedness for new challenges
- Results of survey on biomediated processes
- OPCW Laboratory



Decontamination of sarin

Professor Joseph Wang (University of California, San Diego) described the accelerated decontamination of CW agents with nano-motors and -rockets



CHEMISTRY

Micromotors detox chemical weapons

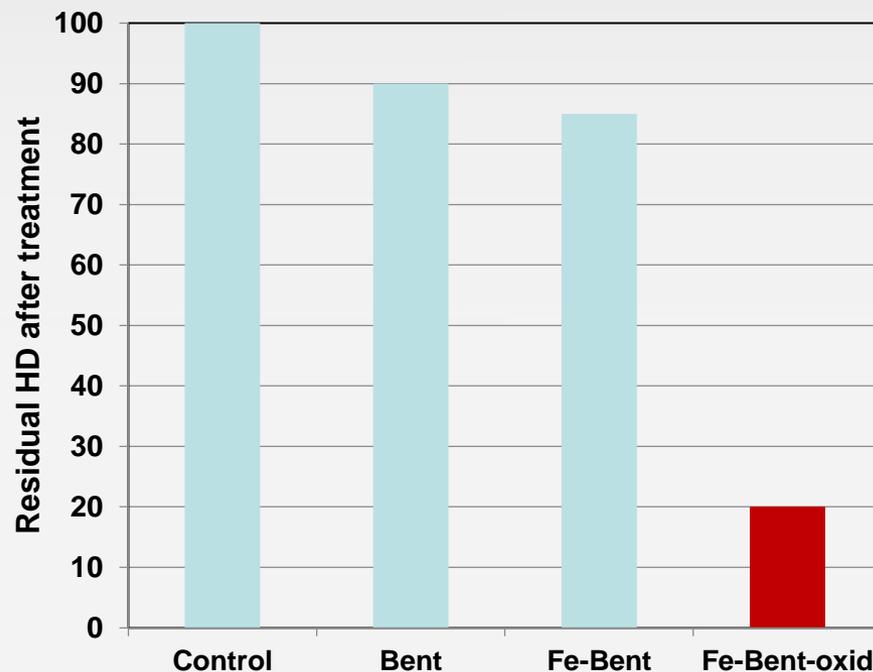
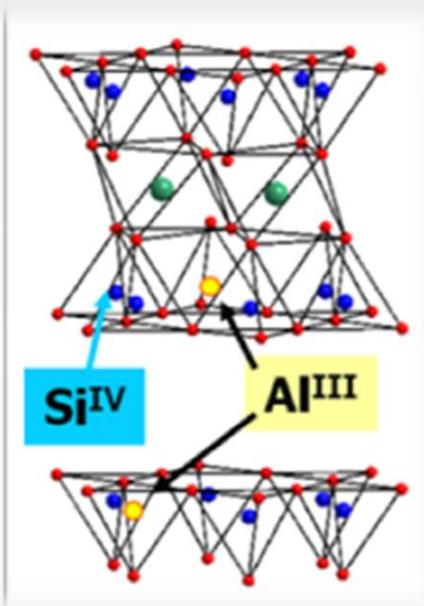
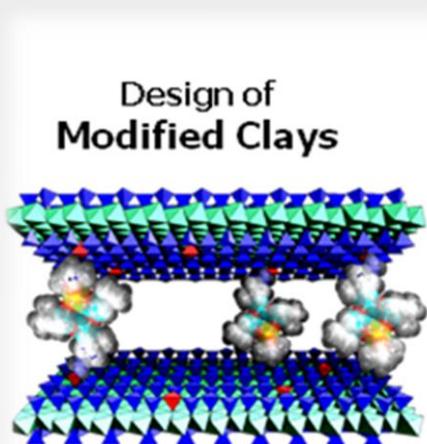
Synthetic micromotors might provide a faster, better way to decontaminate nerve agents.

Converting harmful organophosphate chemicals, such as sarin, into innocuous substances requires high concentrations of hydrogen peroxide and constant stirring over long periods. Such conditions are challenging when eliminating chemical-weapons stockpiles in remote or hostile locations.

Joseph Wang at the University of California, San Diego, and his team overcame these requirements using micromotors made of polymers tipped with platinum. These zip around the contaminated fluid, propelled by bubbles that are produced as platinum reacts with peroxide.

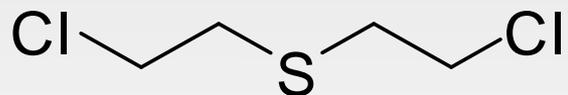
Decontamination of sulfur mustard

Dr Matteo Guidotti (Institute of Molecular Science and Technologies, Italy) presented research on catalytic decontamination of toxic chemicals



Decontamination of sulfur mustard

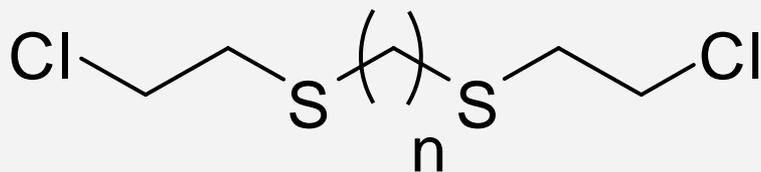
Professor Roberto Martínez-Álvarez (University of Complutense, Madrid) described decontamination studies on sulfur mustard and its impurities



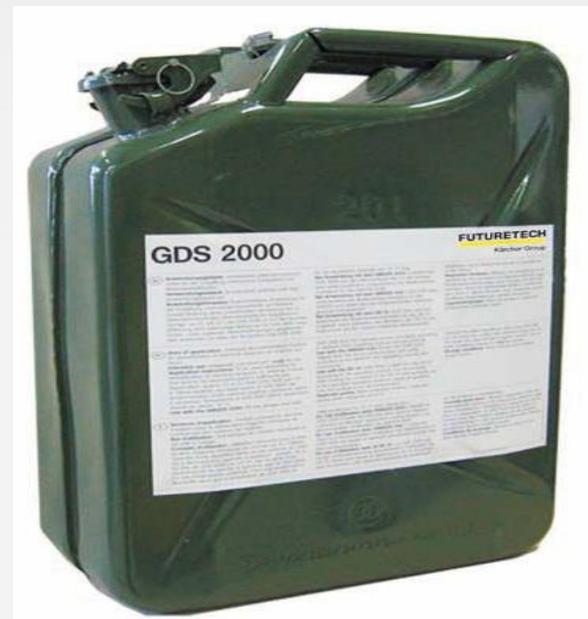
Sulfur mustard, HD



Sesquimustards

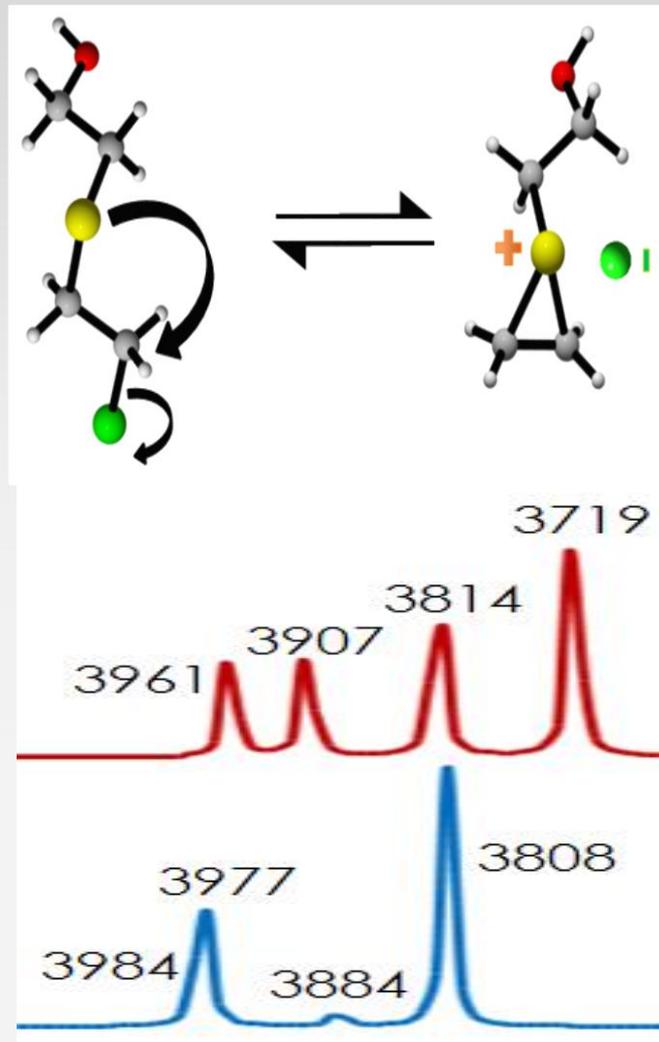
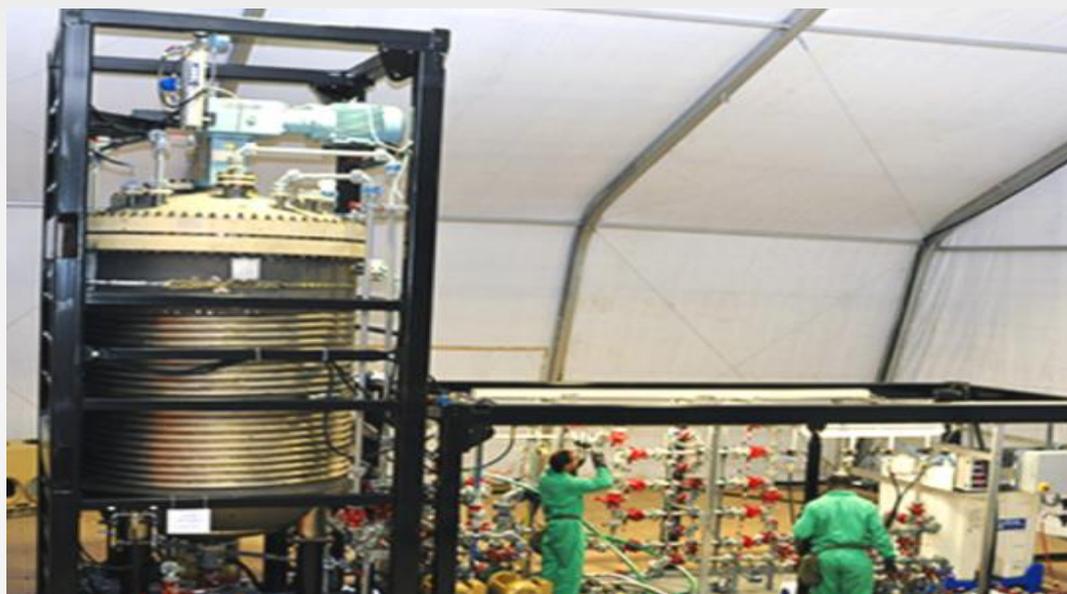


$$n = 1, 2, 3, 4, 5$$



Theoretical study on sulfur mustard

Professor Ponnadurai Ramasami (University of Mauritius) presented computational studies on the chemistry of sulfur mustard

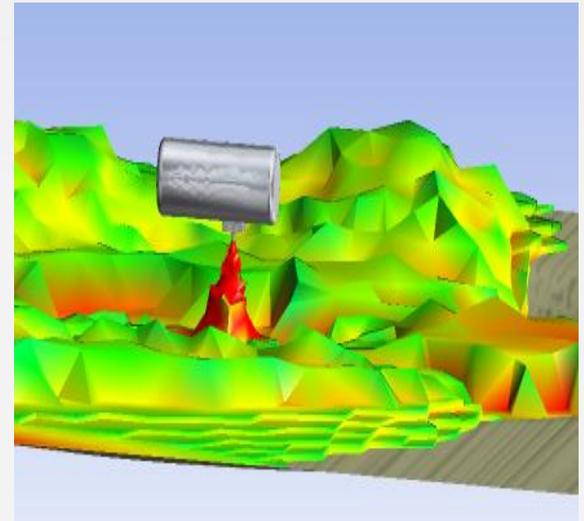
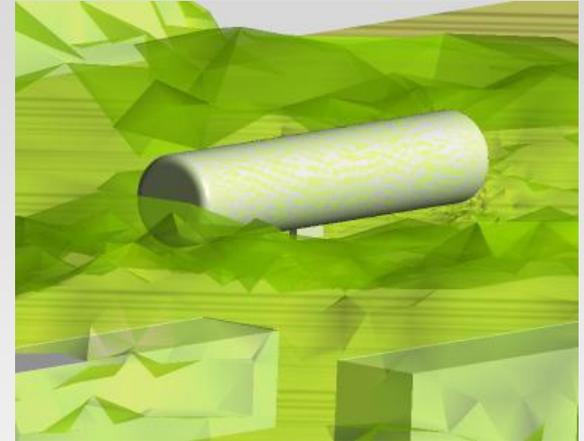


Computational tools applied to CWC implementation

Dr Evandro de Souza Nogueira (MCTIC, Brazil) discussed some computer-aided tools useful for gas plume modelling in response to, and the investigation, of chemical incidents (e.g. chlorine releases)

Such tools can be applied to CWC implementation e.g. in disarmament, non-proliferation matters, assistance and protection, and international cooperation

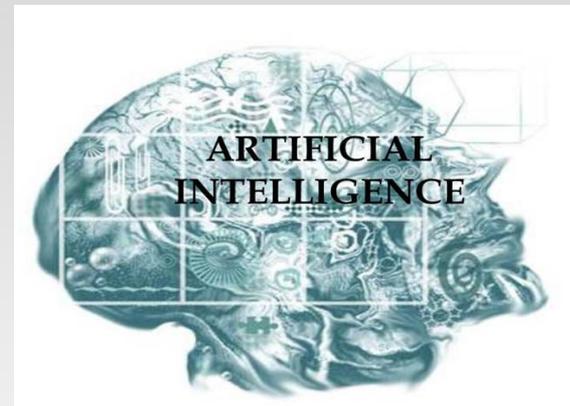
Dispersion models can be helpful if the data they generate can be correlated validated with real-world data



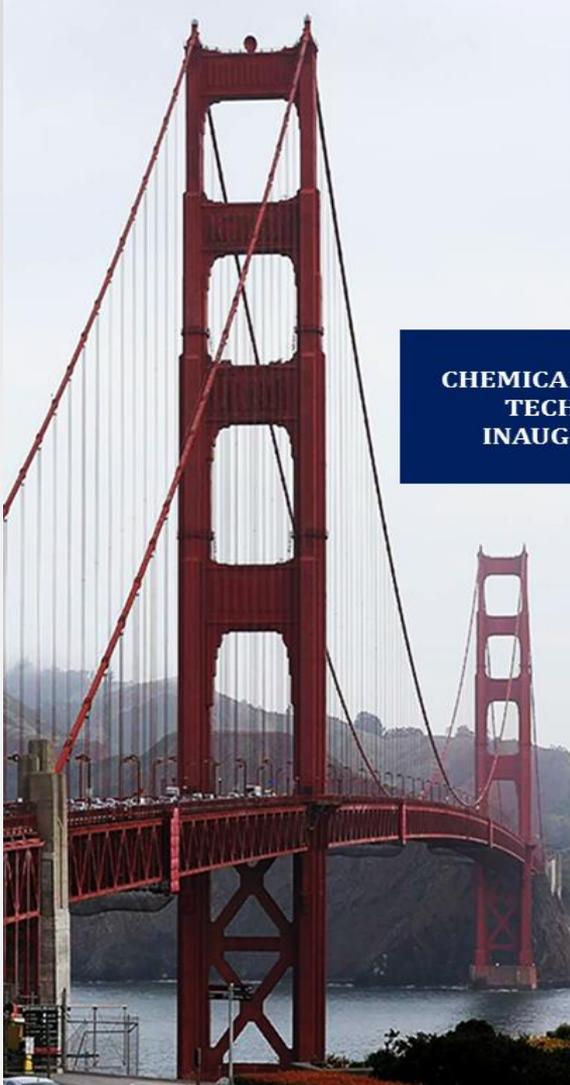
Artificial intelligence (AI) and potential applications to OPCW

Ms Hoe Chee Chua (DSO Laboratory, Singapore) provided several examples of where AI may benefit the OPCW

- Structure generation of unknown impurities found in toxic chemicals (AI might help match analytical data to reference data (e.g. in OCAD))
- Planning of synthesis pathways
- Information management



Chemical Forensics International Technical Working Group



2017

**CHEMICAL FORENSICS INTERNATIONAL
TECHNICAL WORKING GROUP
INAUGURAL WORKSHOP REPORT**

**APRIL 5, 2017
SAN FRANCISCO,
CALIFORNIA, USA**

**CHEMICAL
FORENSICS**
INTERNATIONAL TECHNICAL WORKING GROUP EST. 2017

253rd American Chemical Society
National Meeting & Exposition

Advanced Materials, Technologies, Systems & Processes

APRIL 2-6, 2017 | SAN FRANCISCO, CA



49 participants representing over 27 US/international organizations at the workshop to establish the CFITWG

Engagement with forensic science experts



Engagement with forensic organisations

- **Academia Ibero-americana de Criminalística y Estudios Forenses**
- **African Society of Forensic Medicine**
- **Australian and New Zealand Forensic Science Society**
- **European Council of Legal Medicine**
- **European Network of Forensic Science Institutes**
- **Ibero-american Network of Forensic Medicine and Forensic Science Institutions**
- **International Association of Forensic Sciences**
- **EUROPOL / European Cybercrime Centre**
- **International Academy of Legal Medicine**

Engagement with forensic organisations

- **International Forensic Strategy Alliance**
- **INTERPOL Global Complex for Innovation**
- **INTERPOL International Forensic Science Managers Symposium**
- **Indo-Pacific Association of Law, Medicine and Science**
- **New Mediterranean Academy of Forensic Sciences**
- **Arab Union of Forensics and Toxicology**
- **Southern Africa Regional Forensic Science Network**
- **United Nations Institute for Training and Research
UNITAR/UNOSAT**
- **World Association for Medical Law**

Engagement on science advice to policymakers



The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Meeting of the Board on Chemical Sciences and Technology

1:00 PM **Session 2: Chemical and Biological Defense/Advances in Chemical Sensing**

Moderator: Fran Ligier

Discussion with Federal Leaders

John Fischer, Director, Chemical and Biological Defense Division, Homeland Security Advanced Research Projects Agency, Science and Technology Directorate, Department of Homeland Security

D. Christian Hassell, Deputy Assistant Secretary of Defense for Chemical and Biological Defense, U.S. Department of Defense (invited)

Ronald Hann, Director, Chemical and Biological Technologies Department, Defense Threat Reduction Agency

2:00 PM Presentation: **Sampling and Analysis of Chemical Agents and the Implementation of the Chemical Weapons Convention: Capabilities, Challenges and Opportunities**

Jonathan Foreman, Science Policy Adviser, Organisation for the Prohibition of Chemical Weapons

2:30 PM Panelists:

Kenneth Suslick, Marvin T. Schmidt Professor of Chemistry, Professor of Materials Science & Engineering, and Professor of the Beckman Institute for Advanced Science and Engineering at the University of Illinois at Urbana-Champaign

Brandy White, Research Chemist, U.S. Naval Research Laboratory

Brandi Vann, Lead, C/B Detection Systems Development, Chemical and Biological Technologies Department, Defense Threat Reduction Agency





OPCW

December 2018: A Time to Review

Third Special Session of the
Conference of the States
Parties to Review the
Operation of the Chemical
Weapons Convention

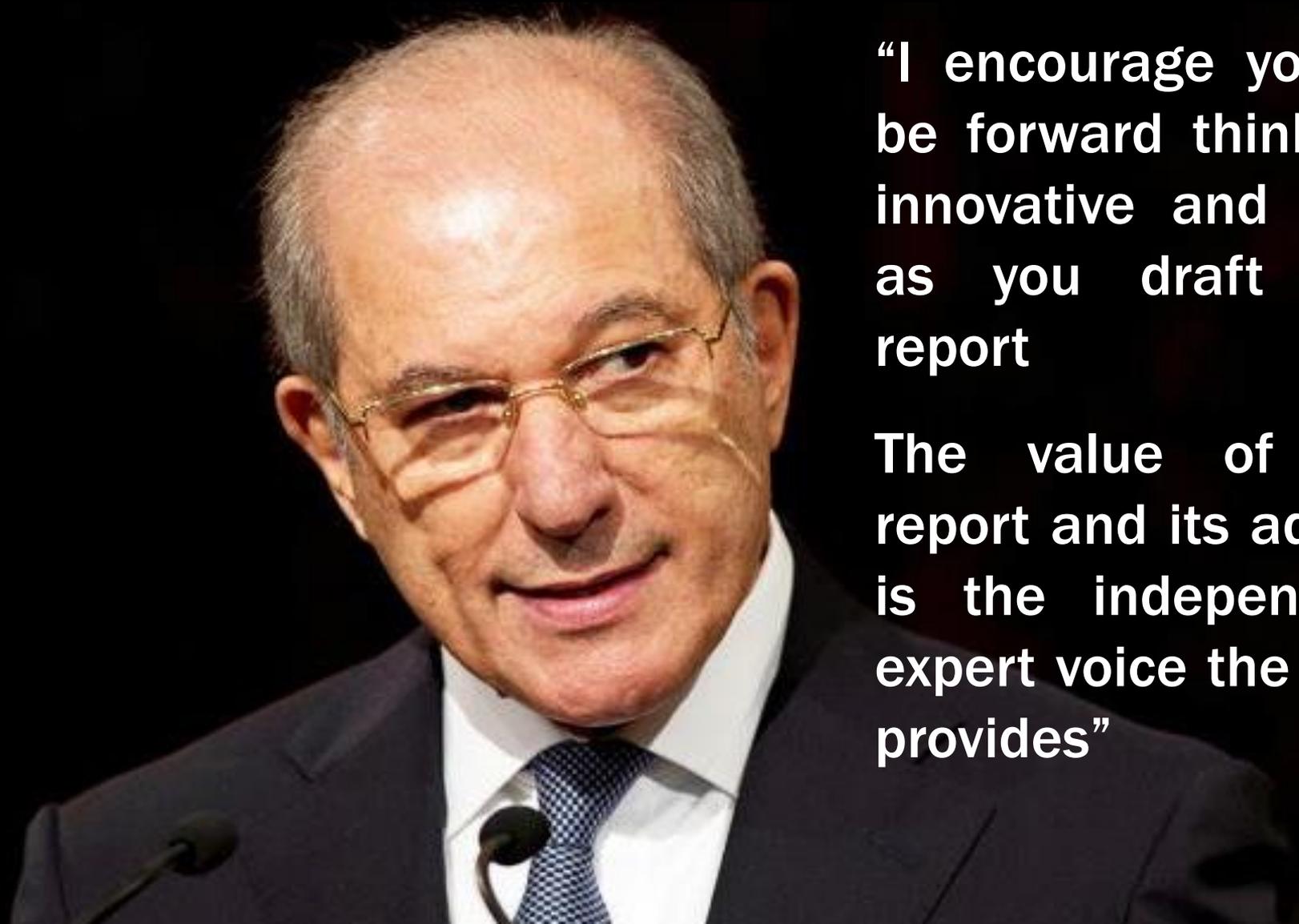
8 - 18 April 2019

Organisation for the Prohibition of Chemical Weapons

SAB Report:

Overview of scientific and technological changes during review period
Advice on relevant and emerging areas of science and technology
Recommendations for moving forward

SAB report to the Fourth Review Conference



“I encourage you to be forward thinking, innovative and bold as you draft this report

The value of the report and its advice is the independent expert voice the SAB provides”

SAB report to the Fourth Review Conference

Part A : Issues that may impact the scope of CWC

Summary of overall content of report as well as a section that provides insight into issues underlying advances such as the diffusion of knowledge and drivers of technology development

Part B: Issues related to the Technical Secretariat

Relevance of general trends to work of the Secretariat, including advice of trends to follow and S&T of relevance beyond then SAB report to the Fourth Review Conference

SAB report to the Fourth Review Conference

Advances in science and technology

Convergence

Enzymes

Metabolic engineering

Green chemistry (connection to goals of CWC)

Nanotechnology (catalysts, medicines, toxicology)

Chemical production technologies

Additive manufacturing

Big data, informatics, artificial intelligence

Delivery systems

Horizon scanning, monitoring trends and technology foresight

SAB report to the Fourth Review Conference

Advice on chemicals including Schedules of Chemicals

Scheduled chemicals (isotopic labels/stereoisomers)

Riot control agents, CNS-acting chemicals, toxins

OCAD, Proficiency Testing

Verification technologies

Analytical instrumentation

Forensic science methods (including chemical forensics)

Biomedical samples

Sampling and analysis

Sample preparation, sample storage and stability

Environmental samples (including plant biomarkers)

Remote sensing, sensors and smart devices, drones

SAB report to the Fourth Review Conference

Destruction of chemical weapons

CW destruction methods

Decontaminants (including enzymes)

Assistance and protection

Treatment and therapeutics (including long-term effects)

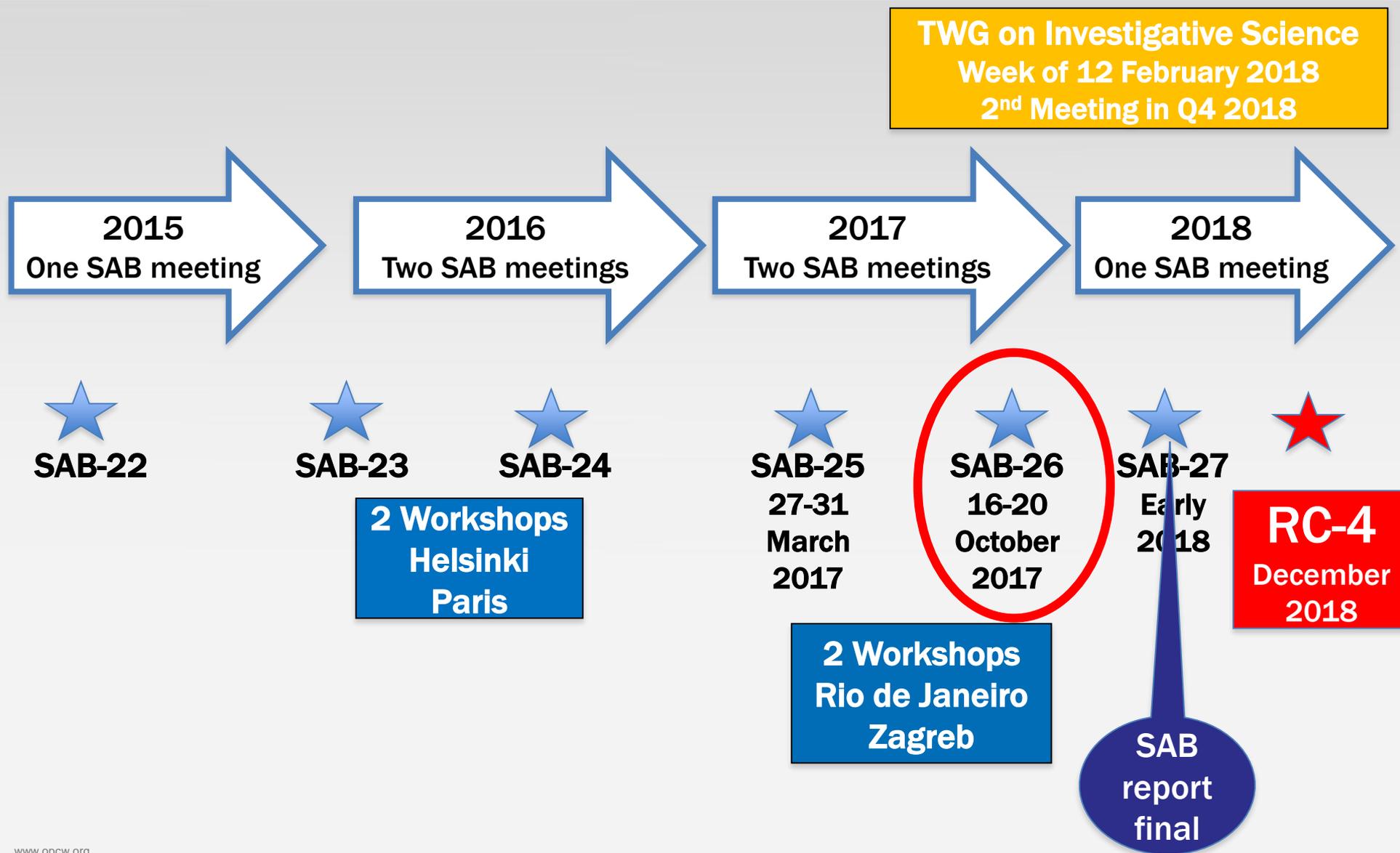
Medical countermeasures and physical protection

Science advice/science policy-maker engagement

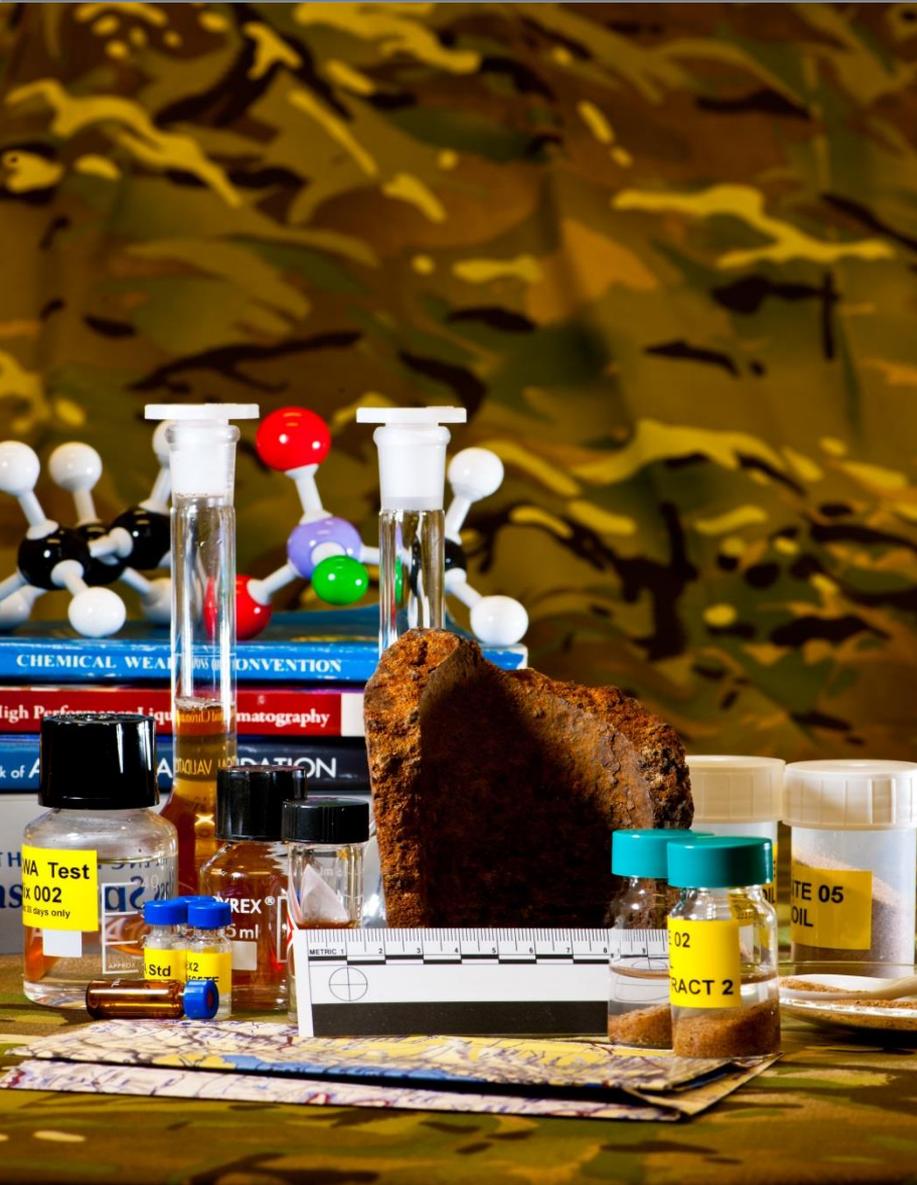
Science advice mechanisms

Work of science advisor bodies

Timeline for SAB report to the Fourth Review Conference



TWG on Investigative Science and Technology



TWG on Investigative Science and Technology

- Ongoing contingency operations have increasingly involved investigations, analysis, and fact-finding, with collection and evaluation of oral, material, and digital evidence of the use of chemical agents
- Objective is to review the science and technology relevant to investigations mandated under the CWC
- This will include science and technology for the validation and provenancing (i.e. determining the chronology of ownership, custody and/or location) of evidence, and integration of multiple and diverse inputs to reconstruct a past event

TWG on Investigative Science and Technology

- **Work of the TWG is intended to identify capabilities, skill sets, and equipment that would augment and strengthen the investigative capabilities of OPCW**
- **TWG will comprise individuals who collectively have expertise in the 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 CWC**
- **Dr Veronica Borrett appointed as TWG Chairperson**



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Working Together For a World Free of Chemical Weapons

Temporary Working Group on Investigative Science and Technology

Reporting to the Scientific Advisory Board (SAB), the Temporary Working Group (TWG) will in particular consider the following questions:

Question 1:

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



Question 2:

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?



Question 3:

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



Question 4:

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



Question 5:

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?



Question 6:

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



Question 7:

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



Question 8:

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)?



Question 9:

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



Question 10:

Do collections of physical objects, samples, and other information for chemical weapons-related analysis exist and can they be made available to investigators for retrospective review? How might these collections be used to support investigations?



Question 11:

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



In addition, the TWG will provide advice on Technical Secretariat proposals for methodologies, procedures, technologies, and equipment for investigative purposes.



TWG on Investigative Science and Technology

Veronica Borrett (TWG Chair)

Augustin Baulig

Christophe Curty

David Gonzalez

Robert Mikulak

Syed Raza

Valentin Rubaylo

Francois van Straten

Farhat Waqar

Cheng Tang (SAB Vice-Chair)

Christopher Timperley (SAB Chair)

Crister Åstot

Brigette Dorner

Caros Fraga

Daan Noort

Paula Vanninen

Ed van Zalen

Australia

France

Switzerland

Uruguay

USA

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FOI Sweden

RKI, Germany

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Netherlands Forensic Institute

Publications

03-05 JULY - 2017
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INTERNATIONAL WORKSHOP ON INNOVATIVE TECHNOLOGIES FOR CHEMICAL SECURITY

Science for Peace

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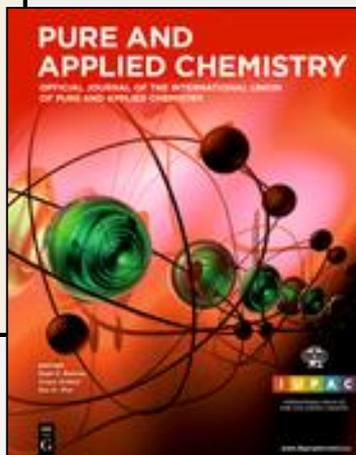
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SAB sample storage and RCA reports?

Others?



Riot Control Agents

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What is the definition of a Riot Control Agent (RCA)?
From paragraph 1, 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."

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

- 1. Chloroacetophenone (CN)
- 2. Chlorobenzylidene malononitrile (CS)
- 3. Chloroacetophenone (CN)
- 4. Chloroacetophenone (CN)
- 5. Chloroacetophenone (CN)

How do Riot Control Agents work?
RCAs produce irritation through binding to TRP (Transient Receptor Potential) receptors. This activates some of the same biochemical pathways that are triggered by eating horseradish or hot peppers.

What are TRP Receptors?
TRP receptors are a family of ion channel receptors mainly located on cell membranes of multicellular organisms. TRP receptors are classified into seven subfamilies: TRPC (canonical or classical), TRPV (vanilloid), TRPM (melastatin), TRPA (ANKK1A homologues), TRPP (glycylglycine), TRPML (mammalian), and TRPML2 (mammalian).

TRP receptor functions are diverse; the receptors serve as versatile sensors that allow individual cells and entire organisms to detect changes in their environment. This includes experiencing changes in temperature, touch, taste and other stimuli (including pain).

TRPA1
CS and isothiocyanate compounds bind to the TRPA1 receptor. Allyl isothiocyanate is the main pungent ingredient in wasabi, horseradish, and mustard oil. This chemical also binds to the TRPA1 receptor.

TRPV1
Capsaicin, homocapsaicin, and other related compounds bind to the TRPV1 receptor. These chemicals are naturally found in hot chili peppers.

Special issue with workshop participants (to be published in 2018)

Thank you for your attention



"Working together for a
world free of chemical weapons"