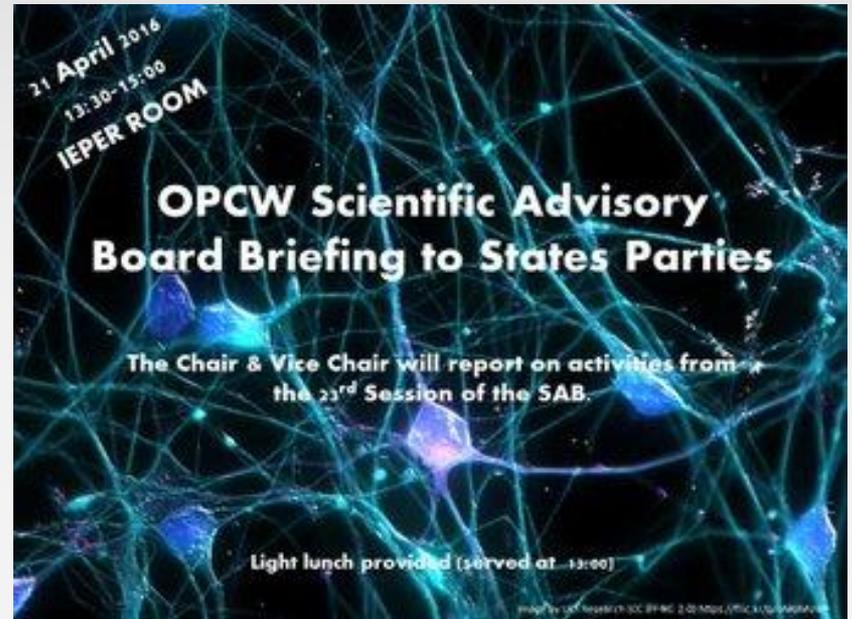




SAB-23



Dr Christopher Timperley and Mr Cheng Tang



SAB composition

New members

Prof. Ponnadurai Ramasami (Mauritius)

Prof. Isel Pasual Alonso (Cuba)

Mrs. Farhat Waqar (Pakistan)

Dr. Robert Mikulak (USA)

Dr. Christophe Curty (Switzerland)

Dr. Zrinka Kovarik (Croatia)





Science and the CWC

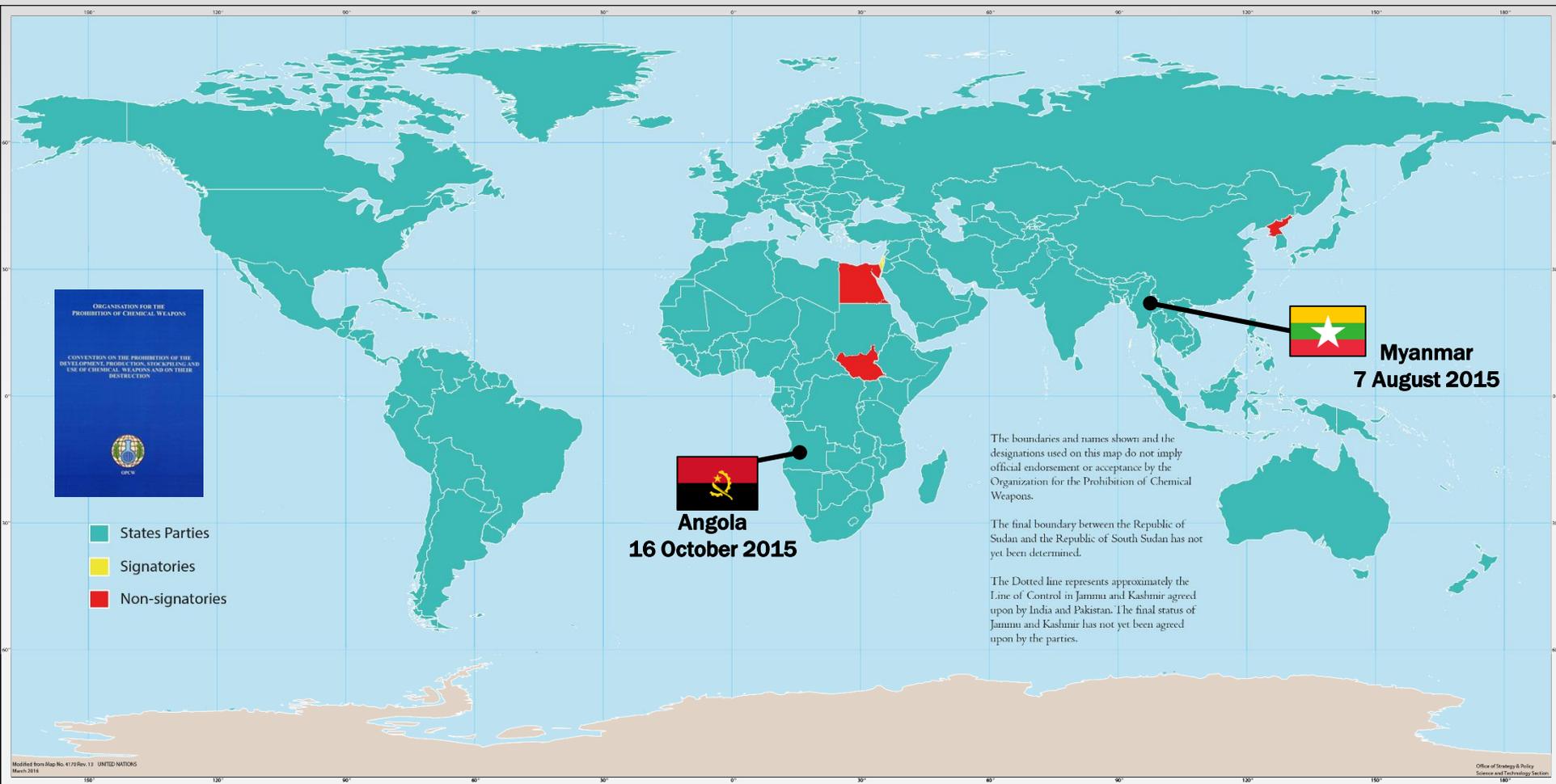
Science and technology underpins many Articles of the CWC

- Art II** definitions
- Art III** declarations (accurate and complete)
- Art IV** destruction methodologies
- Art VI** verification methodologies such as S&A
- Art VII** effective national implementation depends in part on
S&T knowledge/awareness/outreach
- Art IX/X** investigations, assistance, challenge, inspections
- Art XI** peaceful use (e.g. outreach)

Science and technology is central to OPCW's Medium Term Plan

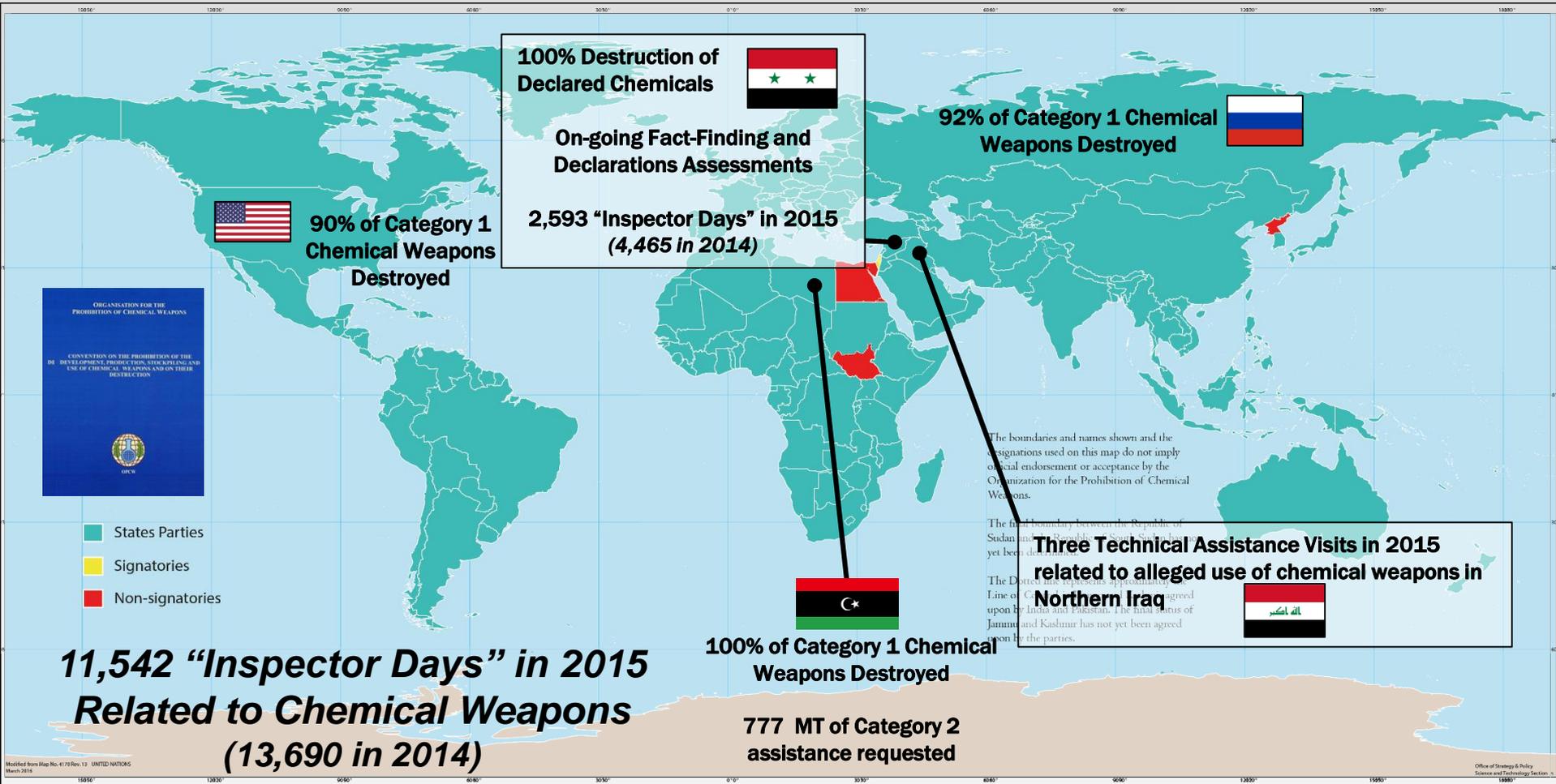


192 States Parties





192 States Parties





SAB recommendations 2013 - 2015



OPCW **Conference of the States Parties**

Third Review Conference RC-3/DG.2
8 – 19 April 2013 31 January 2013
Original: ENGLISH

NOTE BY THE DIRECTOR-GENERAL

**RESPONSE BY THE DIRECTOR-GENERAL
TO THE REPORT OF THE SCIENTIFIC ADVISORY BOARD
ON DEVELOPMENTS IN SCIENCE AND TECHNOLOGY
FOR THE THIRD SPECIAL SESSION OF THE CONFERENCE OF
THE STATES PARTIES TO REVIEW THE OPERATION
OF THE CHEMICAL WEAPONS CONVENTION**

www.opcw.org/fileadmin/OPCW/CSP/RC-3/en/rc3dg02_e.pdf

CONVERGENCE OF CHEMISTRY AND
BIOLOGY

REPORT OF THE SCIENTIFIC ADVISORY
BOARD'S TEMPORARY WORKING GROUP

JUNE 2014



ORGANISATION FOR THE PROHIBITION
OF CHEMICAL WEAPONS



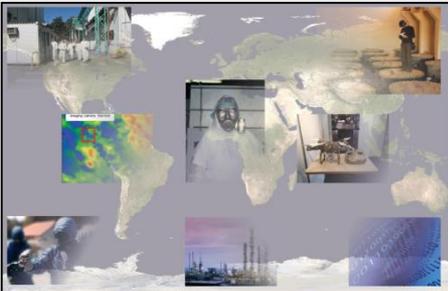
EDUCATION AND ENGAGEMENT:
Promoting a Culture of Responsible Chemistry

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

NOVEMBER 2014



ORGANISATION FOR THE PROHIBITION
OF CHEMICAL WEAPONS



VERIFICATION

REPORT OF THE SCIENTIFIC ADVISORY
BOARD'S TEMPORARY WORKING GROUP

June 2015



ORGANISATION FOR THE PROHIBITION
OF CHEMICAL WEAPONS



SAB recommendations 2013 - 2015



OPCW Conference of the States Parties

Third Review Conference 8 – 19 April 2013 RC-3/DG.2
31 January 2013
Original: ENGLISH

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www.opcw.org/fileadmin/OPCW/CSP/RC-3/en/rc3dg02_e.pdf

CONVERGENCE OF CHEMISTRY AND BIOLOGY

REPORT OF THE SCIENTIFIC ADVISORY BOARD'S TEMPORARY WORKING GROUP



OPCW Executive Council

Eightieth Session 6 – 8 October 2015 EC-80/DEC.5
8 October 2015
Original: ENGLISH

DECISION

ESTABLISHMENT OF AN ADVISORY BOARD ON EDUCATION AND OUTREACH



OPCW Executive Council

Eightieth Session 6 – 9 October 2015 EC-80/DG.7
28 August 2015
Original: ENGLISH

NOTE BY THE DIRECTOR-GENERAL

THE IMPACT OF DEVELOPMENTS IN SCIENCE AND TECHNOLOGY IN THE CONTEXT OF THE CHEMICAL WEAPONS CONVENTION



OPCW Executive Council

Seventy-Seventh Session 7 – 10 October 2014 EC-77/DG.10
5 September 2014
Original: ENGLISH

NOTE BY THE DIRECTOR-GENERAL

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

EDUCATION AND ENGAGEMENT:
Promoting a Culture of Responsible Chemistry

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

NOVEMBER 2014



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

VERIFICATION

REPORT OF THE SCIENTIFIC ADVISORY BOARD'S TEMPORARY WORKING GROUP

June 2015



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS



SAB engagement with States Parties

SAB-22

EC-80

Industry Cluster

BWC

Meeting of experts
Meeting of States Parties

Science for Diplomats

OPCW International Day

National Authorities

Education and Outreach
Advisory Board



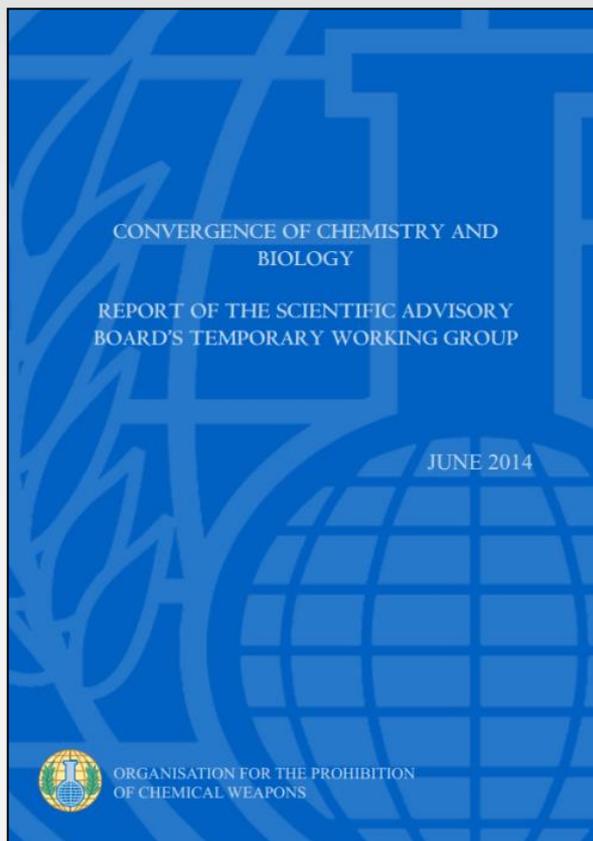
International Day for
the Foundation of the
Organisation for the
Prohibition of Chemical
Weapons

Chemical Safety and Security in a
Technologically Evolving World

www.opcwday.org #opcwday 2 - 4 May 2016

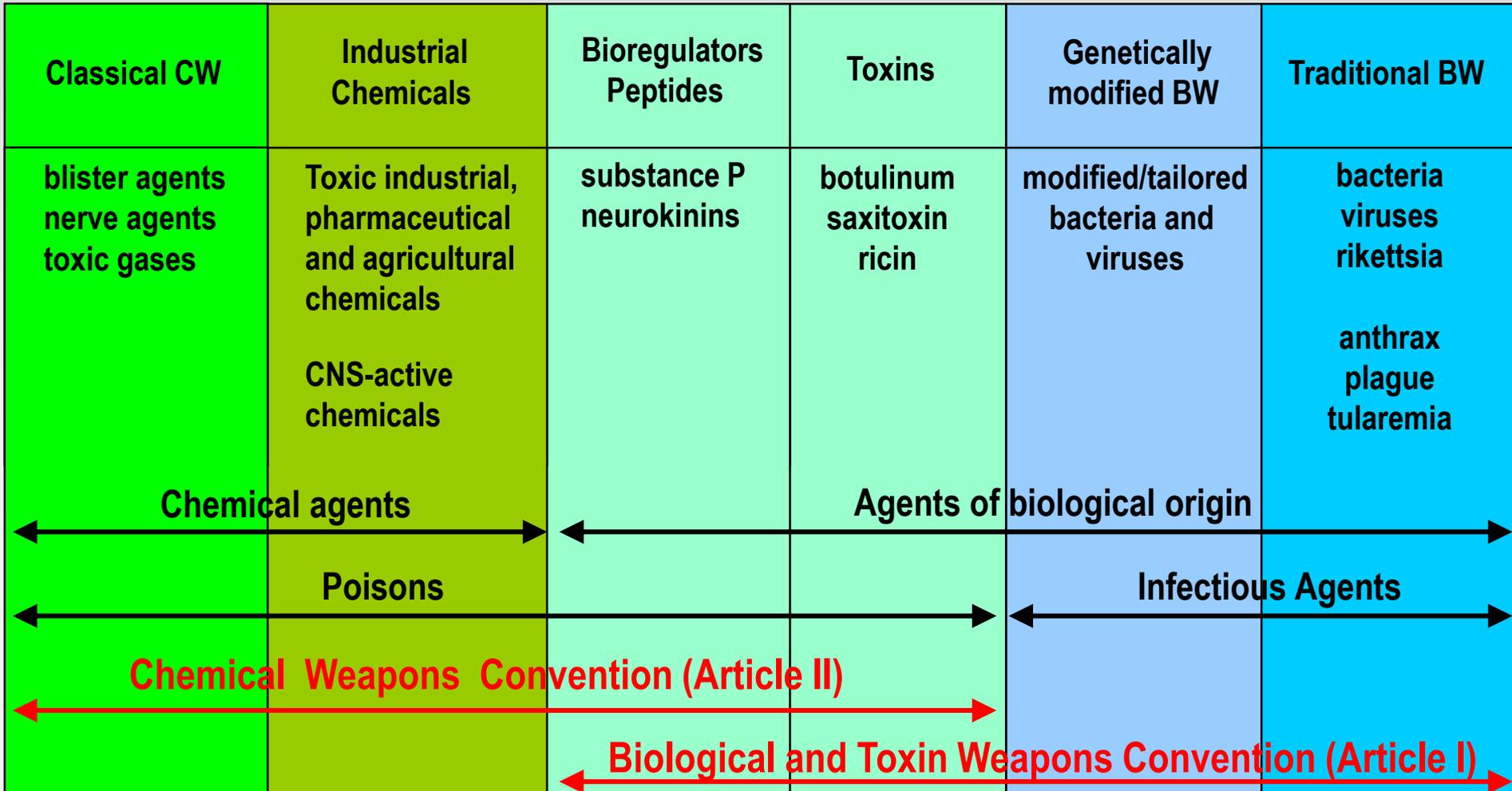


Convergence





CWC and BWC threat spectrum



Adopted from Graham S Pearson, ASA Newsletter, 90-1, February 1990 and Robert Mathews at TWG on Convergence, 1st Meeting 2011.



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Working Together For a World Free of Chemical Weapons

Recommendations From The OPCW Scientific Advisory Board's Report on Convergence of Chemistry & Biology

Recommendation 1

The SAB, or a suitable TWG, and the TS should continue to monitor advances in production facilities and technologies, and related trends such as outsourcing and modularisation of equipment. Assessments should be made on a periodic basis to determine their relevance to verification under the CWC. Regular engagement with subject matter experts, e.g. from the biotechnology industry, will be required.



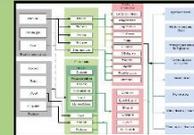
Recommendation 2

The SAB should monitor developments in biological and biologically-mediated chemical production processes, such as metabolic engineering, synthetic biology and associated enabling technologies. Regular engagement with subject matter experts will be required.



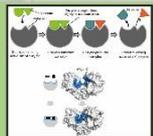
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The SAB should continue to monitor the range of chemicals being studied and produced using biological or biologically-mediated processes.



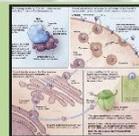
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The SAB, or a suitable TWG, should review advances in rational enzyme design prior to the next review conference.



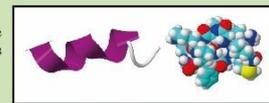
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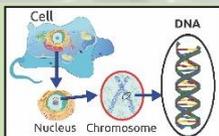
Recommendation 6

The TS should increase and maintain in-house knowledge of bioregulators, and possible applications of new developments in drug delivery.



Recommendation 7

The SAB, or a suitable TWG, should review the synthesis of replicating organisms prior to the next review conference.



Recommendation 8

The SAB, or a suitable TWG, should review progress in the use of enzymes for decontamination prior to the next review conference.



Recommendation 9

The OPCW should monitor advances in protective equipment and possible applications for OPCW personnel as they become commercially available.



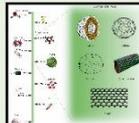
Recommendation 10

The OPCW should consider possible applications of diagnostic devices to on-site activities as they become commercially available.



Recommendation 11

The SAB should monitor advances in nanotechnology prior to the next review conference. Regular engagement with subject matter experts will be required.



Recommendation 12

The SAB and TS should examine ways to increase and maintain in-house, high level knowledge of a broader range of scientific disciplines.



<https://www.opcw.org/special-sections/science-technology/science-technology-memory/>

Recommendation 13

A venue like the TWG on convergence of chemistry and biology should continue to exist, possibly as a temporary working group or a standing arrangement under the SAB.



Recommendation 14

National Authorities could be encouraged to engage more actively on convergence issues, including interacting with relevant biological and chemical scientific communities and hosting relevant events. A standing item on science and technology at National Authority Days might provide an opportunity to promote and report back on such an activity. Adopting convergence as a major theme for a future National Authority Day would help draw attention to this issue.



Recommendations 15 & 16

The SAB and TS should continue to work across areas of overlap between the CWC and the BWC. The Director-General might ask States to consider knowledge of the biological sciences when considering nominating experts to the SAB.



The TS, supported by the SAB, should continue to participate in such meetings and continue to address convergence.

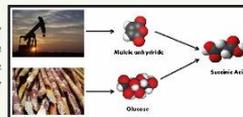
Recommendation 17

The Director-General might consider meeting with the Chair of the BWC and heads of relevant international scientific bodies to explore issues around convergence.



Recommendation 18

Taking into consideration the convergence of chemistry and biology as it relates to the synthesis of chemicals, the TWG was of the view that any process designed for the formation of a chemical substance should be covered by the term 'produced by synthesis'.



Recommendation 19

The TS should review the technical feasibility of converting a bio-based chemical processing facility to produce chemicals of concern to the CWC.



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/opcwonline



/company/opcw



/opcw

Report available at: https://www.opcw.org/fileadmin/OPCW/SAB/en/TWG_Scientific_Advisory_Group_Final_Report.pdf



OPCW

Executive Council

Seventy-Seventh Session
7 – 10 October 2014

EC-77/DG.10
5 September 2014
Original: ENGLISH

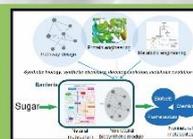
NOTE BY THE DIRECTOR-GENERAL

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

CONVENTION OF CHEMICAL WEAPONS

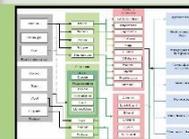
of Chemical Weapons

Director's Report on Convergence of Chemistry & Biology



Recommendation 3

The SAB should continue to monitor the range of chemicals being studied and produced using biological or biologically-mediated processes.



Recommendation 6

Annex

SUMMARY OF ACTIONS TO IMPLEMENT THE RECOMMENDATIONS MADE BY THE SCIENTIFIC ADVISORY BOARD
IN ITS REPORT ON THE CONVERGENCE OF CHEMISTRY AND BIOLOGY⁶

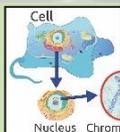
Recommendation of the Scientific Advisory Board	Implementation			
	Regular TS ⁷ and SAB monitoring	SAB/TS workshops (2015-17)	SAB report to RC-4	Other
Recommendation 1: The SAB, ⁸ or a suitable TWG, ⁹ and the TS should continue to monitor advances in production facilities and technologies, and related trends such as outsourcing and modularisation of equipment. Assessments should be made on a periodic basis to determine their relevance to verification under the CWC. ¹⁰ Regular engagement with subject matter experts, e.g. from the biotechnology industry, will be required.	✓ (TS: OSP ¹¹ , VER ¹² , INS ¹³)	✓	Likely	• A SAB TWG could potentially be established in 2016-17 (it could consider all the topics of recommendations 1-11)
Recommendation 2: The SAB should monitor developments in biological and biologically-mediated chemical production processes, such as metabolic engineering, synthetic biology and associated enabling	✓ (TS: OSP, VER)	✓	Likely	-

6 SAB/REP/1/14, dated 27 June 2014
7 TS = Technical Secretariat
8 SAB = Scientific Advisory Board
9 TWG=Temporary Working Group
10 CWC = Chemical Weapons Convention
11 OSP = Office of Strategy and Policy
12 VER = Verification Division
13 INS = Inspectorate Division

www.opcw.org/fileadmin/OPCW/SAB/en/ec77dg10_e_.pdf

Recommendation 7

The SAB, or a suitable TWG, should review the synthesis of replicating organisms prior to the next review conference.



Recommendation 10

The OPCW should consider possible applications of diagnostic devices to on-site activities as they become commercially available.



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Recommendations for continued monitoring

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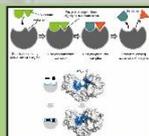
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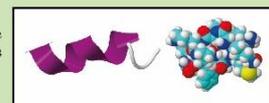
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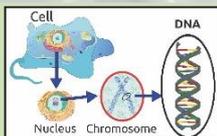
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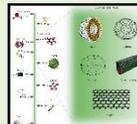
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The SAB and TS should examine ways to increase and maintain in-house, high level knowledge of a broader range of scientific disciplines.



<https://www.opcw.org/chemical-weapons/chemical-weapons-technology/science-and-technology-repository/>

We discussed during SAB-23:

- Bio-based chemical production
- Science advice mechanisms (focus on discussions at BWC)

Recommendations 15 & 16

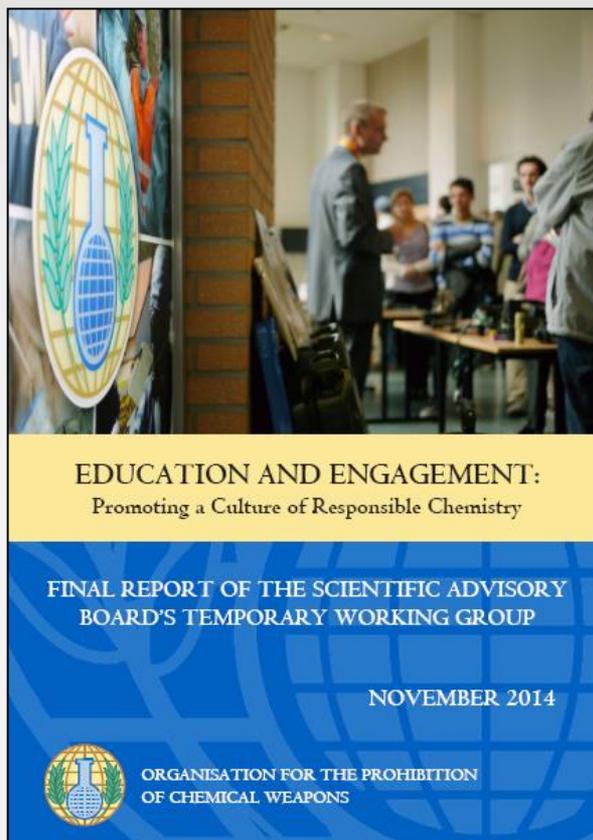
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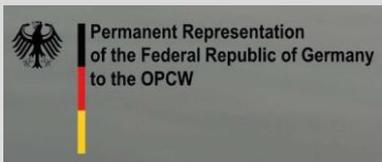
The TS, supported by the SAB, should continue to participate in such meetings and continue to address convergence.





Education and Outreach





The Hague Ethical Guidelines

Participants of 2nd Workshop



Guidelines endorsed by :

- Professor Muhamad Abdulkadir (Indonesia)
- Professor Jasim Uddin Ahmad (Bangladesh)
- Professor Abeer Al-Bawab (Jordan)
- Professor Fernando Albericio Palomera (Spain)
- Professor Jan Apotheker (The Netherlands)
- Professor Mahdi Balali-Mood (Islamic Republic of Iran)
- Professor Djafer Benachour (Algeria)
- Dr Mark Cesa (United States of America)
- Professor Al-Nakib Chowdhury (Bangladesh)
- Dr Philip Coleman (South Africa)
- Professor Dr Hartmut Frank (Germany)
- Professor David Gonzalez (Uruguay)
- Professor Alastair Hay (United Kingdom of Great Britain and Northern Ireland)
- Mr Steven Hill (United States of America)
- Professor Dr Henning Hopf (Germany)
- Dr Jo Husbands (United States of America)
- Professor Jorge Guillermo Ibañez Comejo (Mexico)
- Mr Amirhossein Imani (Islamic Republic of Iran)
- Dr Nancy Jackson (United States of America)
- Dr Patrick John Lim (Philippines)
- Professor Mohd Jamil Maah (Malaysia)
- Dr Detlef Maennig (Germany)
- Professor Peter Mahaffy (Canada)
- Dr Robert Mathews (Australia)
- Professor Temechegn Engida (Ethiopia)
- Dr Kabrena Rodda (United States of America)
- Dr Ting Kueh Soon (Malaysia)
- Professor Alejandra Graciela Suarez (Argentina)
- Professor Leiv K. Sydnes (Norway)
- Mr Cheng Tang (China)
- Professor Natalia P. Tarasova (Russian Federation)
- Dr Christopher Timperley (United Kingdom of Great Britain and Northern Ireland)
- Dr Hans-Georg Weinig (Germany)
- Dr Prashant Yajnik (India)
- Dr Muhammad Zafar-Uz-Zaman (Pakistan)
- Professor Zuriati Binti Zakaria (Malaysia)
- Mr Muhammad Setyabudhi Zuber (Indonesia)



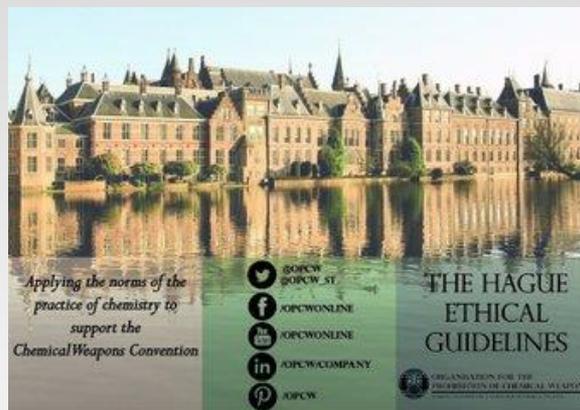
Bangladesh Chemical Society



中华人民共和国工业和信息化部

Ministry of Industry and Information Technology of the People's Republic of China





www.opcw.org/special-sections/science-technology/the-hague-ethical-guidelines

Background

The responsible practice of chemistry improves the quality of life of humankind and the environment. Through their many peaceful uses, such as in research and industry, chemicals play an essential role in this improvement. However, some chemicals can also be used as chemical weapons or to create them, and these weapons are among the most horrific in the world.

The 1993 Chemical Weapons Convention (CWC) embodies the powerful international norm against chemical weapons, requiring its States Parties “never under any circumstances: (a) To develop, produce, otherwise acquire, stockpile or retain chemical weapons, or transfer, directly or indirectly, chemical weapons to anyone; (b) To use chemical weapons; (c) To engage in any military preparations to use chemical weapons; (d) To assist, encourage or induce, in any way, anyone to engage in any activity prohibited to a State Party under this Convention.” The task of destroying the world’s declared stockpiles of chemical weapons is close to completion, but the threats that the use of chemicals as weapons pose to global security have not yet been eliminated.

As destruction of the remaining chemical weapons continues, a concerted effort is needed to prevent their re-emergence. This includes training and raising awareness among chemistry practitioners, defined as anyone trained in chemistry as well as others dealing with or handling chemicals. Their support is needed so that production and use of chemicals is accompanied by recognition of the responsibility to ensure that they are applied solely for peaceful and beneficial purposes. Fortunately, ethical standards established by the global chemistry community already provide a foundation. Building on that foundation, a group of experts from 24 countries from all regions of the world convened to define and harmonize key elements of ethical guidelines as they relate to chemical weapons based on existing codes.¹

Such codes are primary ways through which the community’s ethical standards are addressed. The key elements presented in this text should be incorporated into new and existing codes in order to align with the provisions of the CWC. A code need not mention chemical weapons or the CWC to support its basic goals, and provisions may need to be tailored for particular sectors or circumstances, while still reflecting the fundamental values. Taken together, “The Hague Ethical Guidelines” provide the key elements that should be applied universally.

¹“Code” is used as a general term and includes the full range of such documents, from aspirational statements such as the Hippocratic Oath to codes that are enforceable, for example as part of a practitioner’s terms of employment.

The Key Elements

Core element. Achievements in the field of chemistry should be used to benefit humankind and protect the environment.



Sustainability. Chemistry practitioners have a special responsibility for promoting and achieving the UN Sustainable Development Goals of meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Education.

Formal and informal educational providers, enterprise, industry and civil society should cooperate to equip anybody working in chemistry and others with the necessary knowledge and tools to take responsibility for the benefit of humankind, the protection of the environment and to ensure relevant and meaningful engagement with the general public.



Awareness and engagement. Teachers, chemistry practitioners, and policymakers should be aware of the multiple uses of chemicals, specifically their use as chemical weapons or their precursors. They should promote the peaceful applications of chemicals and work to prevent any misuse of chemicals, scientific knowledge, tools and technologies, and any harmful or unethical developments in research and innovation. They should disseminate relevant information about national and international laws, regulations, policies and practices.

Ethics. To adequately respond to societal challenges, education, research and innovation must respect fundamental rights and apply the highest ethical standards. Ethics should be perceived as a way of ensuring high quality results in science.



Safety and Security. Chemistry practitioners should promote the beneficial applications, uses, and development of science and technology while encouraging and maintaining a strong culture of safety, health, and security.

Accountability. Chemistry practitioners have a responsibility to ensure that chemicals, equipment and facilities are protected against theft and diversion and are not used for illegal, harmful or destructive purposes. These persons should be aware of applicable laws and regulations governing the manufacture and use of chemicals, and they should report any misuse of chemicals, scientific knowledge, equipment and facilities to the relevant authorities.



Oversight. Chemistry practitioners who supervise others have the additional responsibility to ensure that chemicals, equipment and facilities are not used by those persons for illegal, harmful or destructive purposes.

Exchange of information.

Chemistry practitioners should promote the exchange of scientific and technical information relating to the development and application of chemistry for peaceful purposes.

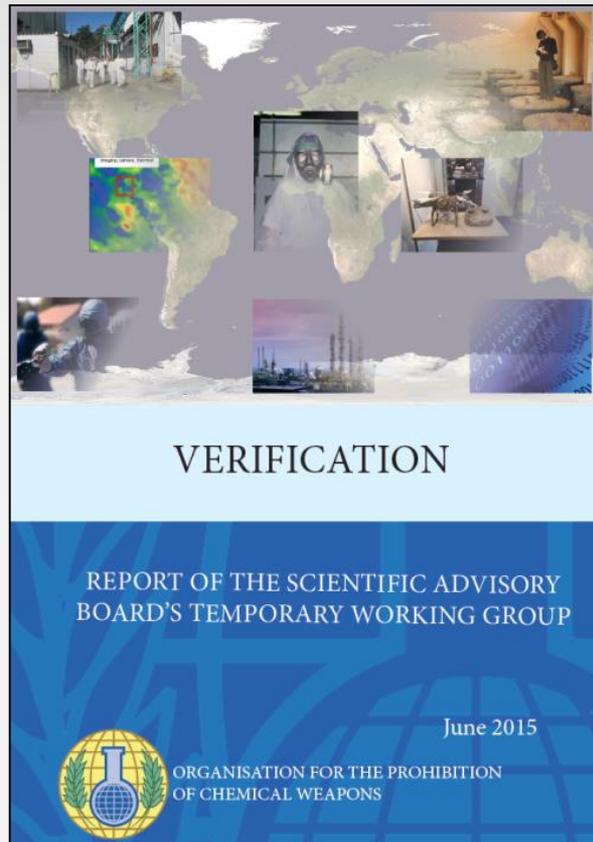


The Participants of the Second Workshop on Ethical Guidelines for the Practice of Chemistry under the Norms of the Chemical Weapons Convention (CWC).

More information is available at <https://www.opcw.org/special-sections/science-technology/the-hague-ethical-guidelines/>



Verification





ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Working Together For a World Free of Chemical Weapons

Recommendations From The OPCW Scientific Advisory Board's Report on Verification

Recommendation 1

The Secretariat should consider adopting a comprehensive, more analytical approach to verification utilising all available and verifiable information.



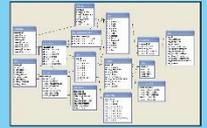
Recommendation 2

The Secretariat should acquire the capability to use open-source information on a routine basis.



Recommendation 3

The Secretariat should put in place an information management structure that can provide the support required for the verification process.



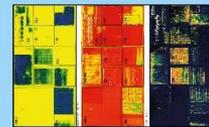
Recommendation 4

Remote/automated monitoring technologies should be added to the list of approved inspection on equipment.



Recommendation 5

The Secretariat should look into the option of using satellite imagery for the planning of non-routine missions, in particular for IAU and CI.



Recommendation 6

The Secretariat should visit the National Authorities to obtain assurance on the accuracy and completeness of declarations. The outcome of such visits may impact on the inspection frequency.



Recommendation 7

The Secretariat must commission an independent review of all activities pertaining to the missions carried out in the Syrian Arab Republic.



Recommendation 8

The list of declarable OCFPs submitted by States Parties should include all facilities which fall under the definition/requirement of paragraph 1 of Part IX of the Verification Annex, regardless of the purity level of a DOC or DOC mixtures produced.



Recommendation 9

Not all facilities that fall under Part IX of the Verification Annex should be considered of the same relevance to the object and purpose of the Convention. The TWG recommends a practical approach for enhancing the utilisation of verification resources for OCFP declaration and on-site inspection processes.



Recommendation 10

The verification thresholds for OCFPs producing highly relevant chemicals, and the possibility of revision of the product group codes, should be addressed by the SAB as well as the industry cluster.



Recommendation 11

The OPCW should increase the staff of the OPCW Laboratory to cope with various aspects of IAU, biomedical samples, trace environmental analysis, toxins, and on-site analysis. Establishing a network of DLs for biomedical sample analysis should be a high priority.



Recommendation 12

Lessons on chemical sampling and analysis from the OPCW's support to the 2013 United Nations Mission to Investigate the Use of Chemical Weapons in the Syrian Arab Republic, and all subsequent OPCW activities in relation to the Syrian Arab Republic must be identified and implemented.



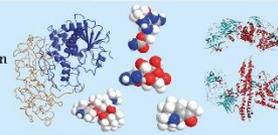
Recommendation 13

FTs should incorporate a broader range of chemicals, and at a wider range of concentrations, to prepare laboratories for IAU-type scenarios.



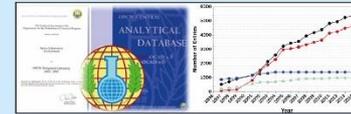
Recommendation 14

The Secretariat should expedite toxin identification exercises.



Recommendation 15

Continuous additions to the OPCW Central Analytical Database (CCAD) are recommended to allow the OPCW to meet all its mandated inspection aims, including IAU.



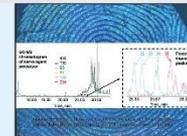
Recommendation 16

Developments in analytical instrument portability, miniaturisation and disposable biosensors should be periodically reviewed by the Secretariat and the SAB for potential applicability to on-site analysis.



Recommendation 17

The Secretariat should monitor developments in attribution analysis/chemical forensics.



Recommendation 18

The Secretariat should augment its capability to monitor and forecast developments in science and technology of relevance to the Convention and its verification regime.



<https://www.opcw.org/special-sections/science-technology/science-technology-monthly/>



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Report available at: https://www.opcw.org/fileadmin/OPCW/SAB/en/Final_Report_of_SAB_TWG_on_Verification_-_as_presented_to_SAB.pdf



Actions to take recommendations forward

OPCW

Executive Council

Eightieth Session
6 – 9 October 2015

EC-80/DG.7
28 August 2015
Original: ENGLISH

NOTE BY THE DIRECTOR-GENERAL

**THE IMPACT OF DEVELOPMENTS IN SCIENCE AND TECHNOLOGY
IN THE CONTEXT OF THE CHEMICAL WEAPONS CONVENTION**

Actions for the
Secretariat to
implement
directly

Issues to be
considered by States
Parties

Annex

**ACTION TO IMPLEMENT THE RECOMMENDATIONS MADE BY THE SCIENTIFIC ADVISORY BOARD
IN ITS REPORT ON VERIFICATION¹¹**

Recommendation from the SAB	Implementation	Expected outcomes/results
<p>Recommendation 1: The Secretariat should consider adopting a comprehensive, more analytical approach to verification utilising all available and verifiable information.</p>	<ul style="list-style-type: none"> Secretariat: Strengthen the overall approach to verification. Explore different ways of working – based on past experiences, notably non-routine missions since 2013 as well as best practices from verification regimes of other organizations. Enhance cross-unit interaction by using project-based management coupled with clear accountabilities. Review the organisational structure to ensure it is fit for purpose in light of future verification needs. Simplify the internal-control regime. Augment the systematic information analysis – conceptual frameworks (including determination of the key information needed for effective verification and how to obtain it), staff posts, and information tools. Assess the degree of implementation of the CWC and determine how to address any gaps. Augment training in the relevant technologies/techniques/tools, e.g. data analysis and geographical mapping capabilities. Resource implications (Medium-Term Plan and annual Programme and Budget): Staffing and investments in and maintenance of IT systems. 	<ul style="list-style-type: none"> Reduced risk of re-emergence of chemical weapons through a comprehensive verification regime that is relevant to all future challenges. Increased completeness of declarations. Reduced declaration discrepancies.
<p>Recommendation 2: The Secretariat should acquire the capability to use open-source information on a routine basis.</p>	<ul style="list-style-type: none"> Secretariat informal paper of 31 July 2012 refers. Secretariat – current use of publicly available information includes: <ul style="list-style-type: none"> Maintaining technical expertise of staff members for effective verification. Assessing developments and trends in the chemical industry 	<ul style="list-style-type: none"> Tailored assistance to current and emerging States Parties for full and effective implementation of Article VI. Increased completeness of declarations.

¹¹ SAB/REP/1/15, dated June 2015, www.opcw.org/fileadmin/OPCW/SAB/en/Final_Report_of_SAB_TWG_on_Verification_-_as_presented_to_SAB.pdf



Recommendations

Recommendation 1

The Secretariat should consider adopting a comprehensive, more analytical approach to verification utilising all available and verifiable information.



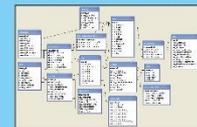
Recommendation 2

The Secretariat should acquire the capability to use open-source information on a routine basis.



Recommendation 3

The Secretariat should put in place an information management structure that can provide the support required for the verification process.



Recommendation 4

Remote/automated monitoring technology should be added to the list of approved inspection equipment.

Recommendation 7

The Secretariat must commission an independent review of all activities pertaining to the inspection carried out in the Syrian Arab Republic.

Recommendation 6

The Secretariat should visit the National Authorities to obtain assurance on the accuracy and completeness of declarations. The outcome of such visits may impact on the inspection frequency.



Authorities to obtain assurance of declarations may impact on



of the Verification relevance to the the TWG recommends a practical approach for enhancing the utilisation



Recommendation from the SAB	Implementation	Expected outcomes/results
<p>Recommendation 6:</p> <p>The Secretariat should visit the National Authorities to obtain assurance on the accuracy and completeness of declarations. The outcome of such visits may impact on the inspection frequency.</p>	<ul style="list-style-type: none"> Secretariat: Develop a conceptual approach. Pilot bilateral visits with interested States Parties (based e.g. on experiences from the previous technical-assistance-visit programme). Develop a programme that takes into account the also the action taken in relation to recommendation 1. Executive Council: Based on experiences with the pilot programme, consider more systematic, comprehensive programme for all States Parties. Consider synergies with other relevant conventions/treaties and their implementing entities. Resource implications (MTP and annual Programme and Budget): Travel cost and possibly staffing. 	<ul style="list-style-type: none"> Full and effective implementation of Articles III-VI. Increased completeness of declarations. Level playing field in the chemical industry. Cost-effective verification.

<https://www.opcw.org/special-sections/science-technology/science-technology-roadmap/>



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/opcwonline



/opcwonline



/company/opcw

Report available at: https://www.opcw.org/fileadmin/OPCW/SAB/en/Final_Report_of_SAB_TWG_on_Verification_-_as_presented_to_SAB.pdf



Technical workshop (9-10 March 2016)

Recommendation 8

The list of declarable OCPFs submitted by States Parties should include all facilities which fall under the definition/requirement of paragraph 1 of Part IX of the Verification Annex, regardless of the purity level of a DOC or DOC mixtures produced.



3 Non-papers
issued by the
Secretariat

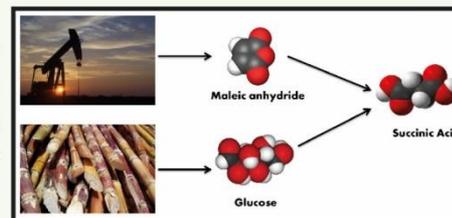
Recommendation 9

Not all facilities that fall under Part IX of the Verification Annex should be considered of the same relevance to the object and purpose of the Convention. The TWG recommends a practical approach for enhancing the utilisation of verification resources for OCPF declaration and on-site inspection processes.



Recommendation 18

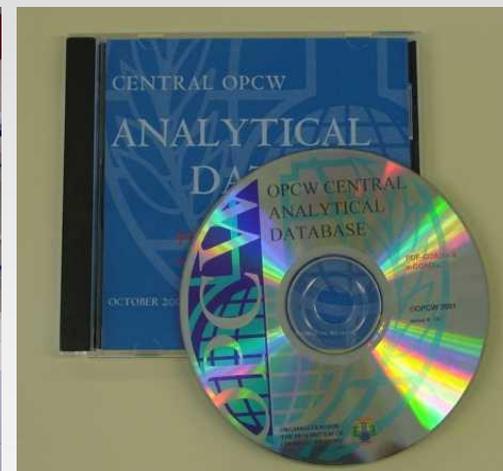
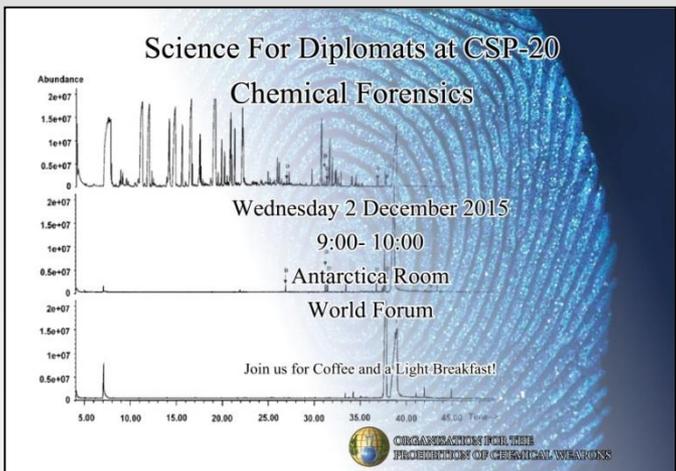
Taking into consideration the convergence of chemistry and biology as it relates to the synthesis of chemicals, the TWG was of the view that any process designed for the formation of a chemical substance should be covered by the term "produced by synthesis".



Workshop discussions summarized in Industry Cluster (11 March)



Chemical forensics



“Nearly two decades after the Chemical Weapons Convention entered into force, the treaty is facing a major test. The threat that toxic gas or nerve agents will be deployed in a conflict between countries has been all but eliminated. Failure to punish their use in the Syrian civil war risks undermining the regime that has brought us to the threshold of a chemical weapons-free world.”

<https://www.project-syndicate.org/commentary/syria-chemical-weapons-attacks-by-ahmet-uzumcu-2016-02#VyEgLMS3SWhrQvAT.99>



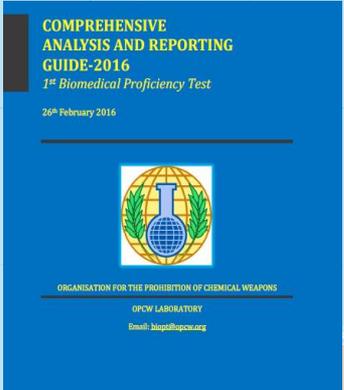
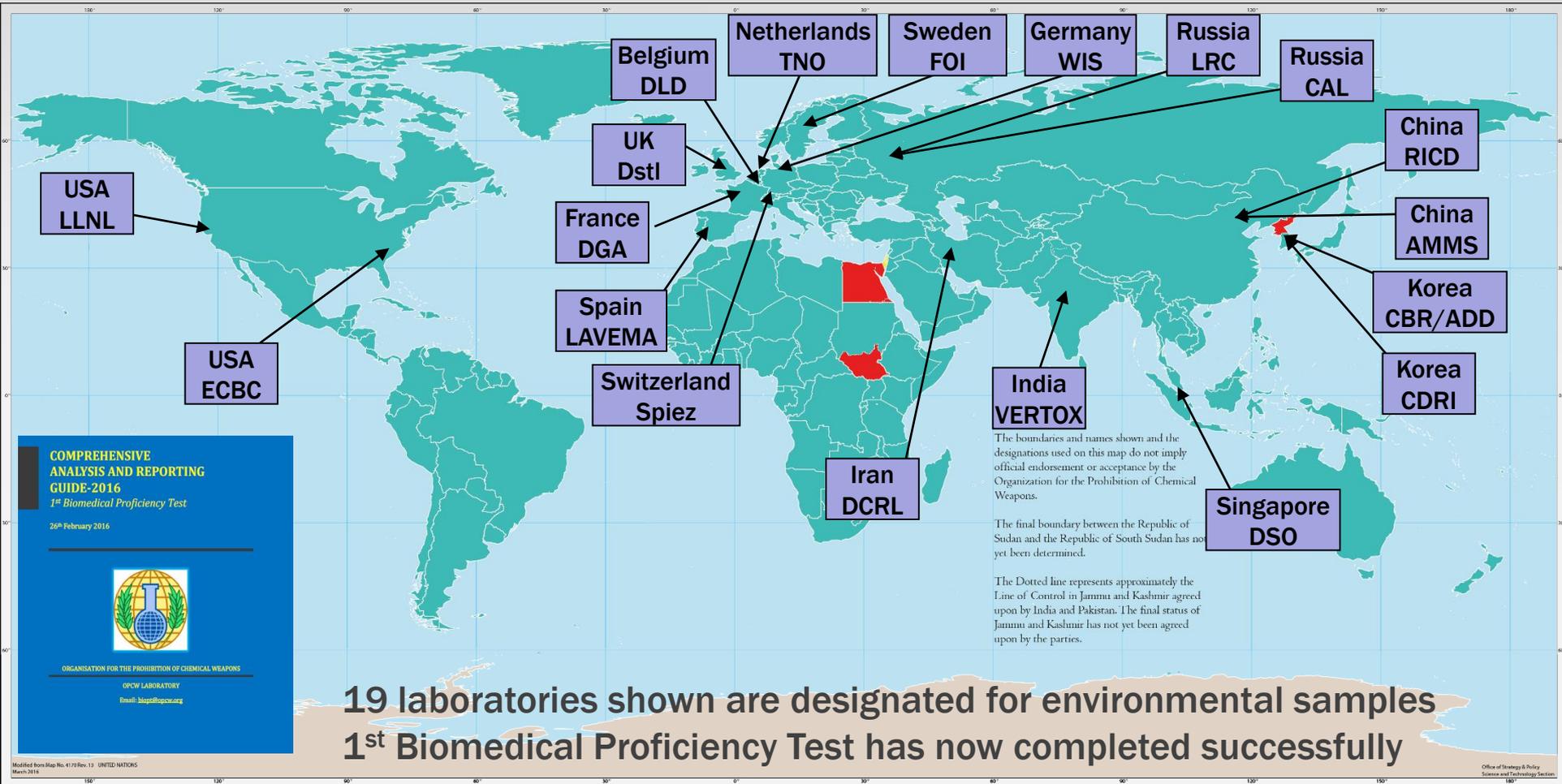
Contingency operations

SAB-23 briefed on the work of Declarations Assessment Team and Fact-Finding Missions

- Areas where S&T would help :
- Information management
- Increased safety measures
- Remote sampling
- Chemical analysis/forensics



OPCW Designated Laboratories



Modified from Map No. 4179/Rev.13 UNITED NATIONS March 2014

Office of Strategy & Policy Science and Technology Section



Advice on long-term stability of samples collected in relation to the potential use of chemical weapons

The SAB has considered the long-term storage and stability of samples collected in the context of the OPCW's investigations, including fact-finding missions and the Declaration Assessment Team, according to the Director-General's questions of 2 November 2015

In the context of the OPCW's investigations, the Technical Secretariat has since 2013 received numerous samples, which are stored in the OPCW Laboratory at room temperature or refrigerated at 4°C

Sample types (whether current or future) – containing chemicals of interest, such as various nerve and blister agents as well as their immediate precursors and degradation products – may include:



Advice on long-term stability of samples collected in relation to the potential use of chemical weapons

- Relatively pure samples;
- Liquid (including extracts) and solid samples containing either relatively high levels or trace levels of the chemicals of interest;
- Highly heterogeneous unprocessed samples – such as soil, metal fragments, paint chips, fragments of highly absorbent material, or wipes – containing either relatively high levels or trace levels of the chemicals of interest; and
- Biomedical samples: blood, plasma, urine, tissue.
- The Director-General requested the SAB to address three questions:



Advice on long-term stability of samples collected in relation to the potential use of chemical weapons

1. Given the current storage conditions in the OPCW Laboratory, how quickly and through what process could the aforementioned types of sample degrade to a point where analysis of the samples would no longer return credible results?

The SAB notes that the analytical findings of the Designated Laboratories from analysis of samples collected in OPCW investigations will always be scientifically accurate because of the stringent forensic checks and balances in place: the findings will always return ‘credible results’ (‘credible’ is defined in the Oxford English Dictionary as ‘able to be believed; convincing’). The results of the analyses will always be convincing and withstand scrutiny both scientifically and legally, especially if presented as evidence in court. The integrity of the procedures established in OPCW Designated Laboratories provides all necessary safeguards and thus protects the off-site analysis process from any suggestion of tampering.



Advice on long-term stability of samples collected in relation to the potential use of chemical weapons

The storage conditions used by the OPCW Laboratory will inevitably and naturally lead to loss of intact original chemicals by degradation in most cases (this phenomenon occurs in every laboratory in the world). It is impossible to put a precise time on how long any chemical will take to degrade, as shelf-life or degradation rate depends on the chemical structure, matrix, the presence of stabilisers and storage conditions, as well as the initial concentration of the chemical. It is only possible to estimate, with considerable uncertainty, a likely storage time, and impossible to state accurately when the various sample types will degrade to a point where analysis would not identify the intact original chemical(s).

The analysis of these samples will return credible analytical results, but with less specific information. The characteristic degradation compounds will still contain the molecular evidence for proving CWA use, or in the case of other investigations, the presence of a CWC-related chemical



Advice on long-term stability of samples collected in relation to the potential use of chemical weapons

It must be noted however, if the agent or precursor is initially present only at trace level, prolonged storage may result in adsorption of the original chemical and/or its degradation product(s) to the container walls, for example. In such cases re-analysis could result in a non-finding of the original chemical and/or its degradation product(s) due to their presence in extremely low concentration, at levels below the instrument detection levels.

Recommendation: Samples should be analysed as soon after collection as possible and the need for storage eliminated or, less favourably, the storage time minimised. Prompt analysis should be viewed as urgent, as the intact original chemicals will provide the strongest basis for confirming the use of chemicals prohibited by the CWC. (This is because the sample stability, and potential impacts of any matrix or environmental factors on the stability of any CWC-relevant chemicals in the sample, will not be known prior to analysis.)



Advice on long-term stability of samples collected in relation to the potential use of chemical weapons

2. What are the best-practice conditions for long term-storage of the different types of sample?

SAB reviewed >180 scientific papers on environmental and biomedical samples, and wrote a questionnaire, which 9 Designated Laboratories returned, asking for information on best-practice storage conditions for the sample types

Recommendations made for storage of the different types of sample

Type	Chemical	Storage Condition	until assignment completed	manufacturer's recommendation	until signs of degradation	up to 2 weeks	2 weeks	up to 1 month	several months	up to 3 months	up to 6 months	at least 6 months	up to 1 year	several years	up to 3 years	up to 5 years	more than 10 years
Commercial or Synthesized, solution	General	refrigerator						■									
		freezer (-20°C)															
		glass container Teflon lined caps			■		■										
Commercial or Synthesized, solution	Scheduled	in dichloromethane refrigerator sealed									■						



Advice on long-term stability of samples collected in relation to the potential use of chemical weapons

3. Given these best-practice storage conditions, how quickly and through what type of process could the different types of samples degrade to a point where analysis of the samples would no longer return credible results?

Based on the review herein of processes by which CWC-relevant chemicals degrade, the SAB assesses that it is difficult, given the incomplete knowledge worldwide of the fate of CWAs and other CWC-relevant chemicals in different matrices, to specify precisely when analysis of a sample would likely no longer identify the intact original chemicals.

The best-practice storage conditions provided in answer to the previous question will extend the time the original chemical in the sample will persist.



Advice on long-term stability of samples collected in relation to the potential use of chemical weapons

3. Given these best-practice storage conditions, how quickly and through what type of process could the different types of samples degrade to a point where analysis of the samples would no longer return credible results?

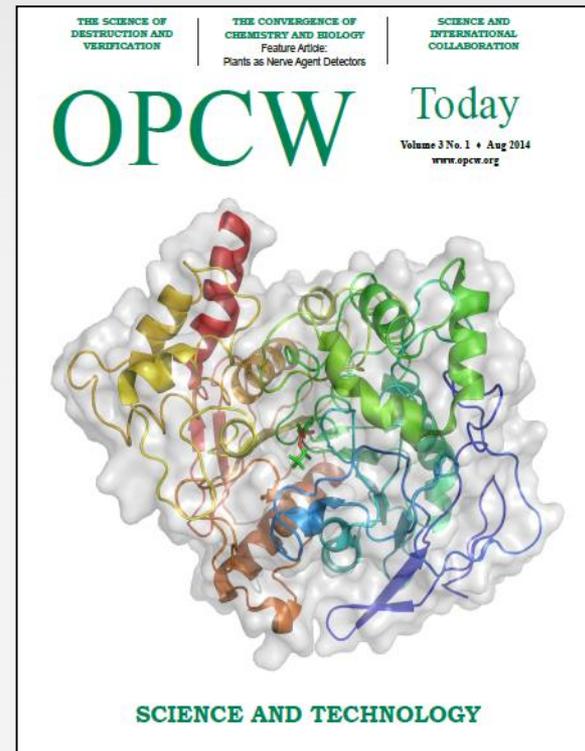
Although some loss of this chemical may occur even under these conditions, the analysis of the samples will return credible analytical results, but with less specific information.

The characteristic degradation products and other chemical residues (such as synthesis by-products and unreacted starting materials) will still provide the molecular evidence necessary for proving CWA production, chemical weapons use or other CWC-related compliance judgement.



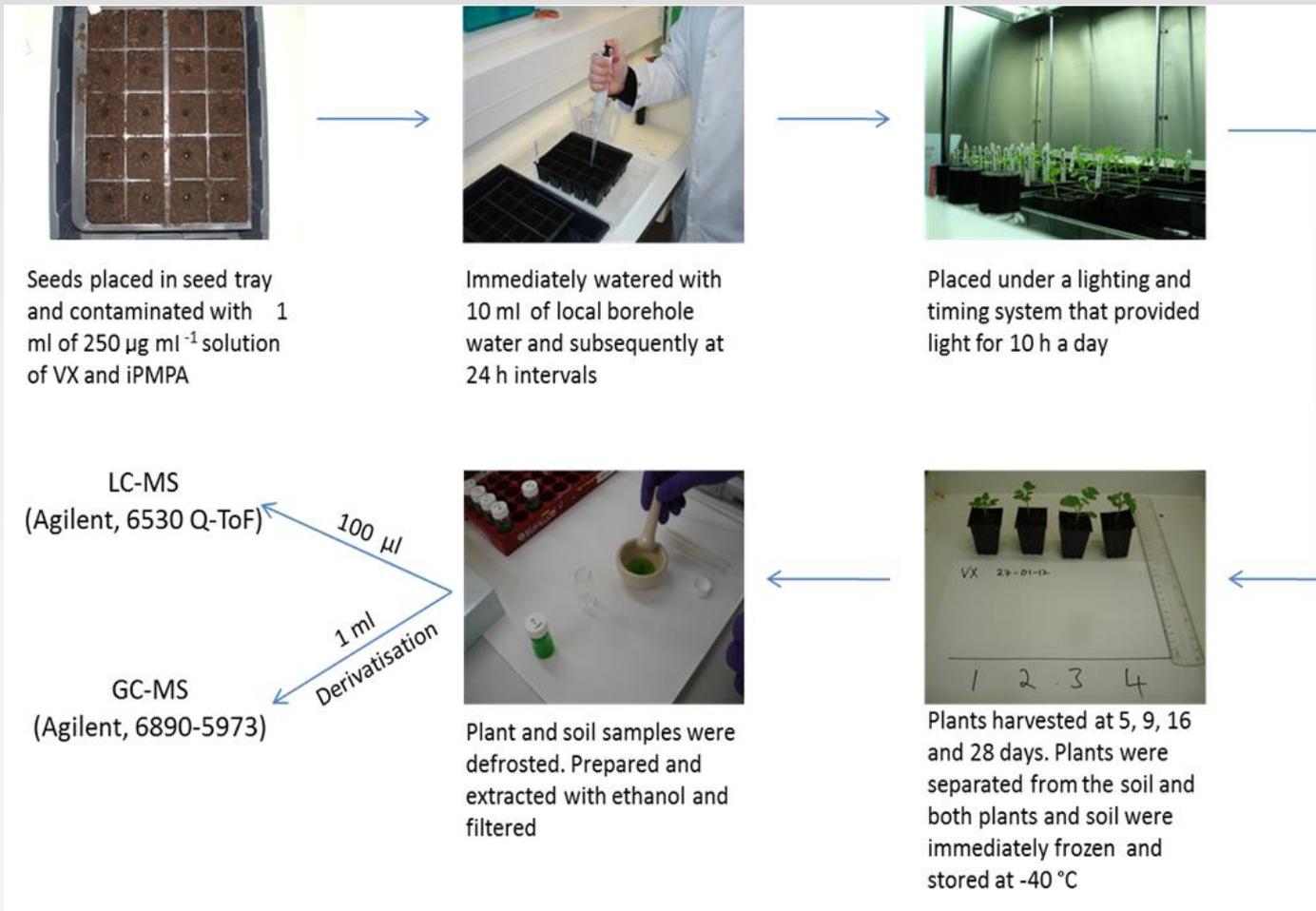
Plants as indicators of nerve agent use

Natural flora can be used to enable the sensitive detection of organophosphorus nerve agents, acting as a time capsule for retaining molecular evidence of use



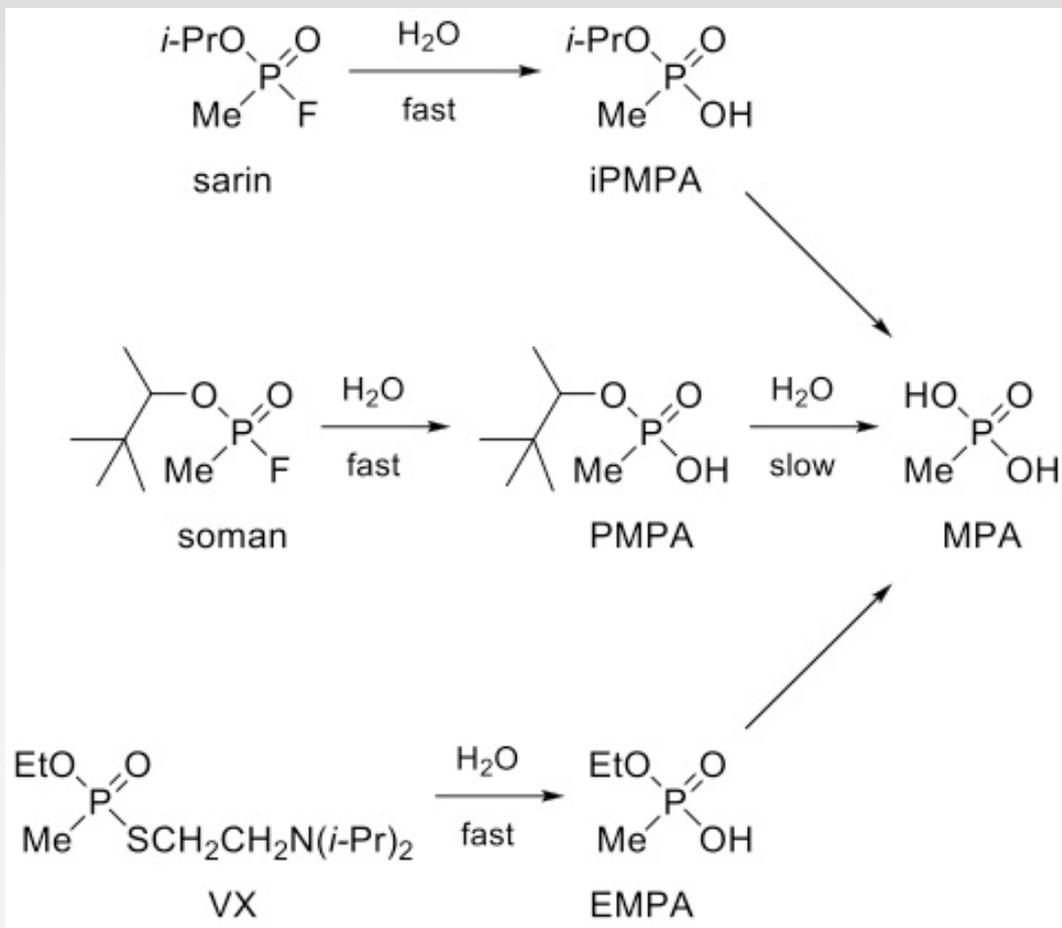


Experimental method

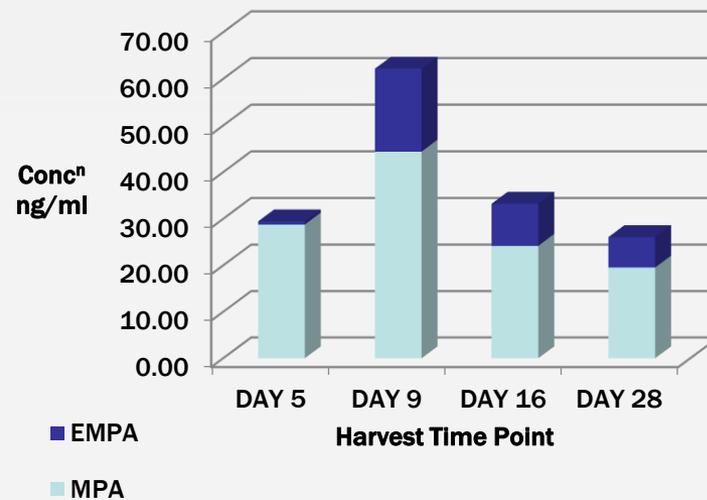
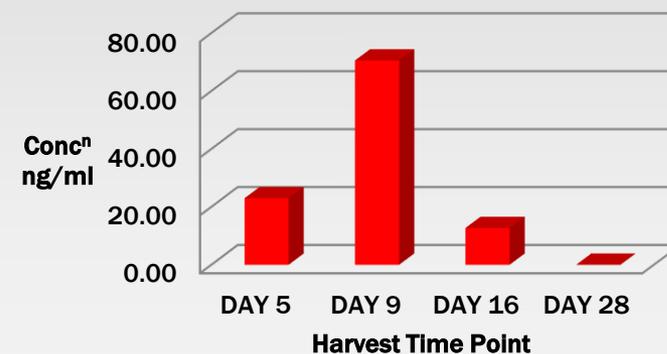




Molecular evidence does not disappear



VX concentration in plants spiked with VX





Analysis of chlorine exposure



SAB-23 received presentations on :

**Investigations of chlorine exposure in
environmental and material samples
Dr Pieter Siegenthaler, Spiez Laboratory**

**Chlorine exposure biomarkers
Dr Christer Astot, FOI Sweden**





ORGANISATION FOR THE
PROHIBITION OF CHEMICAL WEAPONS

Working together for a world free of chemical weapons

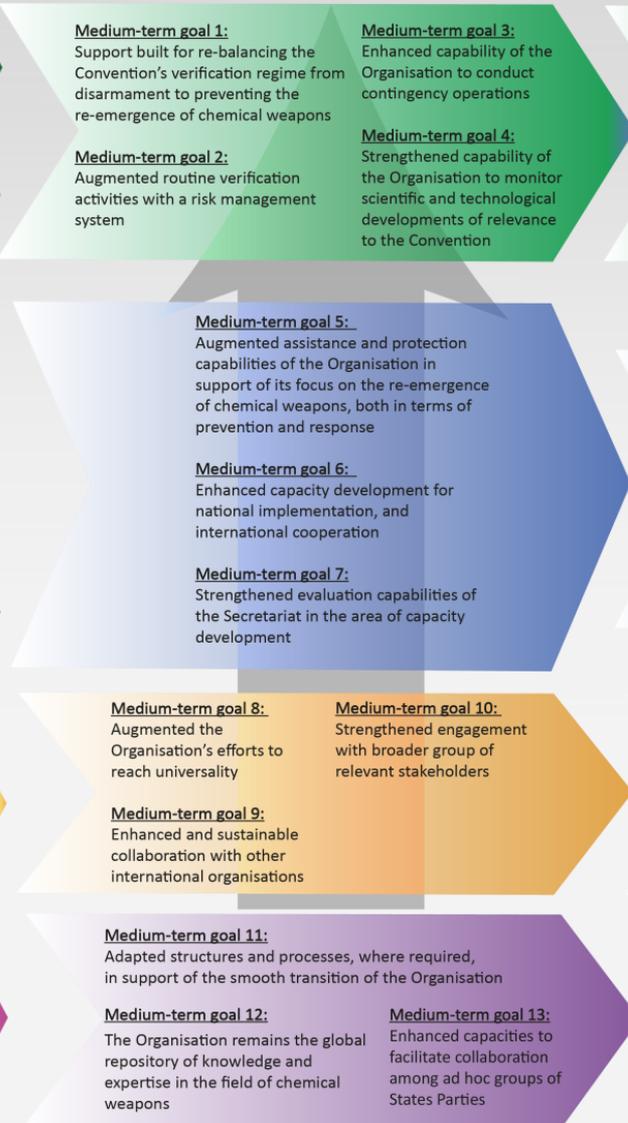
OPCW Medium Term Plan



Seven core objectives

Medium-term goals 2017 – 2021

Four result areas



Ultimate goal of the Convention:
“for the sake of all mankind, to exclude completely the possibility of the use of chemical weapons, through the implementation of the provisions of this Convention”

The Vision of the OPCW is
“to continue to be the premier international organisation working for a world free of chemical weapons, with a focus on preventing their re-emergence, by implementing all provisions of the Convention in an effective, efficient and non-discriminatory manner.”

The OPCW's Mission:
“As a treaty-based international organisation, the OPCW contributes to the disarmament of chemical weapons, to preventing their re-emergence, to providing assistance and protection against them, to supporting national implementation of the Convention, and to facilitating the peaceful uses of chemistry through verification, capacity development or engagement activities.”



Medium term goals 1-4: result area 1

Elimination
of chemical
weapons

Non-proliferation
of chemical
weapons

Medium-term goal 1:

Support built for re-balancing the Convention's verification regime from disarmament to preventing the re-emergence of chemical weapons

Medium-term goal 2:

Augmented routine verification activities with a risk management system

Medium-term goal 3:

Enhanced capability of the Organisation to conduct contingency operations

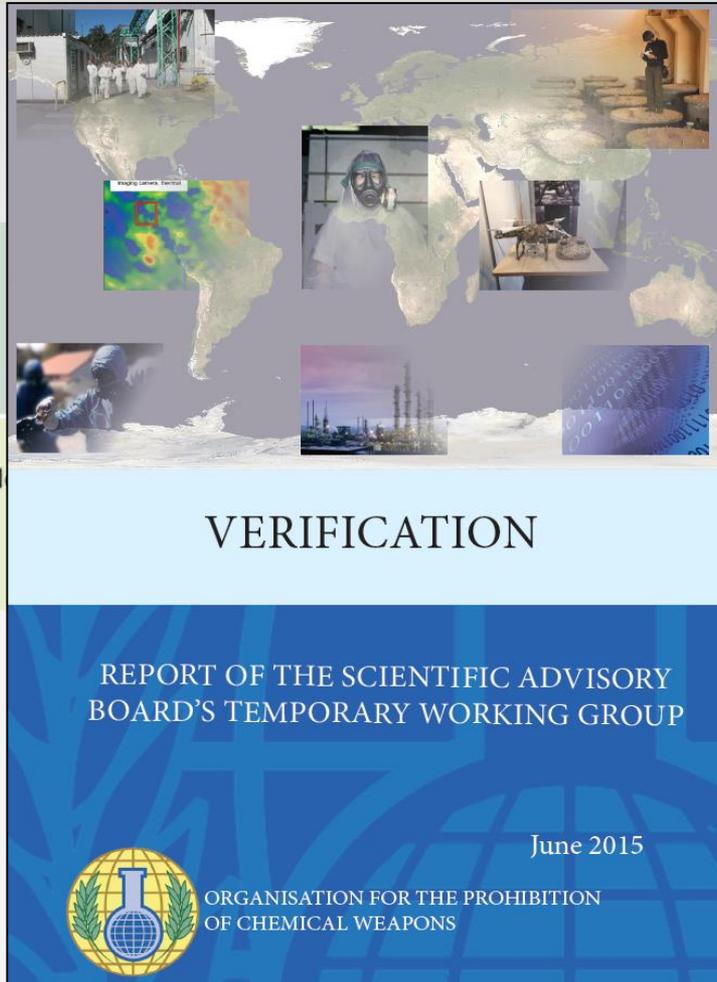
Medium-term goal 4:

Strengthened capability of the Organisation to monitor scientific and technological developments of relevance to the Convention

Verification for continued
confidence in compliance



Medium term goals 1-4: result area 1



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apons

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Enhanced capability of the Organisation to conduct contingency operations

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Verification for continued confidence in compliance



Medium term goals 5-7: result area 2

Assistance &
protection
against CW

Economic &
technological
development through
int. cooperation

Full and effective
implementation
of Article VII

Medium-term goal 5:

Augmented assistance and protection capabilities of the Organisation in support of its focus on the re-emergence of chemical weapons, both in terms of prevention and response

Medium-term goal 6:

Enhanced capacity development for national implementation, and international cooperation

Medium-term goal 7:

Strengthened evaluation capabilities of the Secretariat in the area of capacity development

Capacity development
to prevent and respond
to the hostile use of
toxic chemicals and
to foster international
cooperation



Medium term goals 5-7: result area 2

Assistance &
protection
against CW

Economic &
technological
development through
int. cooperation

Full and effective
implementation
of Article VII

Medium-term goal 5:

Augmented assistance and protection capabilities of the Organisation in support of its focus on the re-emergence of chemical weapons (in terms of prevention and response)

Medium-term goal 6:

Enhanced capacity development for national implementation, and international cooperation

Medium-term goal 7:

Strengthened evaluation capabilities of the Secretariat in the area of capacity development

Capacity development to prevent and respond to the hostile use of toxic chemicals and to foster international cooperation

COOPERATION!



Medium term goals 8-13: result areas 3-4

Universal
adherence
to the Convention

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

Full, effective &
non-discriminatory
implementation
of all CWC provisions

Medium-term goal 11:
Adapted structures and processes, where required,
in support of the smooth transition of the Organisation

Medium-term goal 12:
The Organisation remains the global
repository of knowledge and
expertise in the field of chemical
weapons

Medium-term goal 13:
Enhanced capacities to
facilitate collaboration
among ad hoc groups of
States Parties

An organisation
that remains fit
for purpose



Medium term goals 8-13: result areas 3-4

Universal adherence to the Convention



EDUCATION AND ENGAGEMENT:
Promoting a Culture of Responsible Chemistry

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

NOVEMBER 2014



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Goal 8:
Reports to

Medium-term goal 10:
Strengthened engagement with broader group of relevant stakeholders

Engagement to leverage others' capabilities



OPCW

Executive Council

Eightieth Session
6 – 8 October 2015

EC-80/DEC.5
8 October 2015
Original: ENGLISH

DECISION

ESTABLISHMENT OF AN ADVISORY BOARD ON EDUCATION AND OUTREACH

Full, effective & non-discriminatory implementation of all CWC provisions

Medium-term goal 11:

Adapted structures and processes, where required, in support of the smooth transition of the Organisation

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Medium-term goal 13:

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An organisation that remains fit for purpose



Seven core objectives

Medium-term goals 2017 – 2021

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Advice on isotopically labelled compounds and stereoisomers

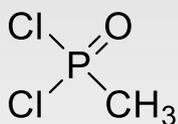
RESPONSE TO THE DIRECTOR-GENERAL'S REQUEST TO THE SCIENTIFIC ADVISORY BOARD TO PROVIDE FURTHER ADVICE ON SCHEDULED CHEMICALS

- 1.1 The Scientific Advisory Board (SAB) has considered isotopically labelled scheduled chemicals and stereoisomers of scheduled compounds relating to the Convention according to the Director-General's requests (see Appendixes 1 and 2).

www.opcw.org/fileadmin/OPCW/SAB/en/sab-23-wp01_e_.pdf



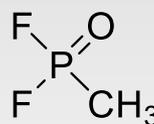
Advice on isotopically labelled compounds and stereoisomers



methylphosphonyl
dichloride

Schedule 2B04

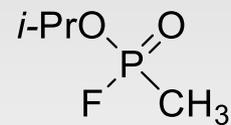
CAS 676-97-1



methylphosphonyl
difluoride

Schedule 1B09

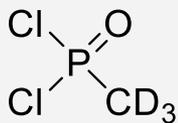
CAS 676-99-3



sarin

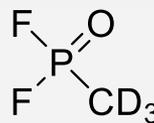
Schedule 1A01

CAS 107-44-8



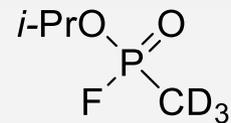
methyl- d_3 -phosphonyl
dichloride

CAS 104801-17-4



methyl- d_3 -phosphonyl
difluoride

CAS 104801-20-9

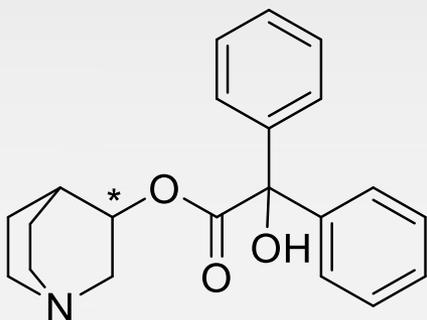


sarin- d_3

CAS 104801-08-3



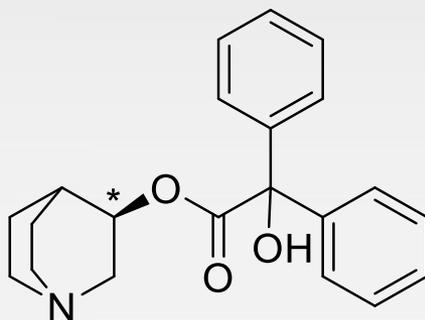
Advice on isotopically labelled compounds and stereoisomers



3-quinuclidinyl benzilate (BZ)

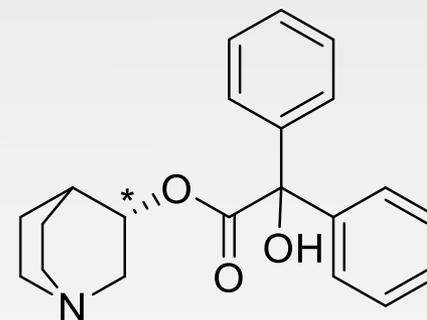
CAS 6581-06-2

Schedule 2A01



(*R*)-(-)-BZ

CAS 62869-69-6



(*S*)-(+)-BZ

CAS 62869-68-5



Advice on isotopically labelled compounds and stereoisomers

- 1.2 **Recommendation 1.** The SAB recommends that the molecular parent structure of a chemical should determine whether it is covered by a schedule entry. This is because:
- (a) it is inappropriate to rely solely upon Chemical Abstracts Service (CAS) numbers to define chemicals covered by the schedules. Although relevant as aids to declaration and verification, CAS numbers should not be used as the means to identify a chemical, or to determine whether a chemical is included in, or excluded from, a schedule;



Advice on isotopically labelled compounds and stereoisomers

- (b) thus, if a chemical is included within a schedule, then all possible isotopically-labelled forms and stereoisomers of that chemical should be included, irrespective of whether or not they have been assigned a CAS number or have CAS numbers different to those shown in the Annex on Chemicals to the Convention. The isotopically labelled compound or stereoisomer related to the parent chemical specified in the schedule should be interpreted as belonging to the same schedule; and
- (c) this advice is consistent with previous SAB views on this topic.¹

1.3 **Recommendation 2.** Inclusion of appropriate analytical data in the OPCW Central Agent Database (OCAD) for isotopically labelled relatives of scheduled compounds where available is recommended.



Central nervous system (CNS) acting chemicals



OPCW

Conference of the States Parties

Twentieth Session
30 November – 4 December 2015

C-20/NAT.2/Rev.2
3 December 2015
ENGLISH only

JOINT PAPER BY

**AUSTRALIA, AUSTRIA, BELGIUM, BRAZIL, BULGARIA, CANADA, CHILE,
CYPRUS, ESTONIA, GERMANY, FINLAND, IRELAND, JAPAN, NEW ZEALAND,
NORWAY, POLAND, PORTUGAL, REPUBLIC OF KOREA, SPAIN, SWITZERLAND,
TURKEY, UNITED STATES OF AMERICA, UNITED KINGDOM OF GREAT BRITAIN
AND NORTHERN IRELAND**

**AEROSOLISATION OF
CENTRAL NERVOUS SYSTEM-ACTING CHEMICALS FOR
LAW ENFORCEMENT PURPOSES**



CNS acting chemicals

2. Toxic (and potentially lethal) chemicals that target the central nervous system (CNS), so-called “incapacitating chemical agents or ICAs”, and their potential use in certain law enforcement scenarios, have been discussed in numerous forums. We believe these chemicals pose a serious challenge for the Convention.
3. CNS-acting chemicals include compounds such as anaesthetics, sedatives and analgesics that have been developed for *bona fide* medical purposes and are designed to be delivered only under strict medical supervision with concurrent monitoring of the individual’s well-being during their administration.

Examples of toxic chemicals specifically mentioned are all anaesthetics: fentanyl, dexmedetomidine, and sevoflurane

Paper notes that these substances are not riot control agents

They cause sedation or death depending on the dose inhaled



CNS-acting chemicals

8. Given the above listed factors, CNS-acting chemicals cannot be dispersed by aerosol in a completely safe manner in law enforcement settings. This also raises concerns that CNS-acting chemicals could be used as chemical weapons.

Previous SAB advice on CNS-acting chemicals :



OPCW

Conference of the States Parties

Third Review Conference
8 – 19 April 2013

RC-3/DG.2
31 January 2013
Original: ENGLISH

NOTE BY THE DIRECTOR-GENERAL

**RESPONSE BY THE DIRECTOR-GENERAL
TO THE REPORT OF THE SCIENTIFIC ADVISORY BOARD
ON DEVELOPMENTS IN SCIENCE AND TECHNOLOGY
FOR THE THIRD SPECIAL SESSION OF THE CONFERENCE OF
THE STATES PARTIES TO REVIEW THE OPERATION
OF THE CHEMICAL WEAPONS CONVENTION**



CNS acting chemicals

Incapacitating chemical agents

15. Since the Second Review Conference, the SAB has conducted a thorough review of the issue of incapacitating chemical agents (ICAs). The Director-General would like to draw the attention of States Parties' to the SAB's assessment that the technical discussion on the potential use of toxic chemicals for law-enforcement purposes has been exhaustive. Regarding the SAB's recommendation that the Secretariat "start preparations for verification activities",⁵ the Secretariat will pursue efforts to enhance its chemical-analysis capabilities and will work with designated laboratories on this issue.

Three SAB-23 agenda items were on CNS acting chemicals :

- Recent interest (SAB Secretary Dr. Jonathan Forman)
- Review of previous SAB advice (Dr. Robert Matthews)
- Detection of CNS acting chemicals (Prof. Paula Vanninen)



Assistance and protection

SAB has provided advice on nerve agent medical countermeasures



OPCW Scientific Advisory Board

Twenty-Second Session
8 – 12 June 2015

SAB-22/WP.2
8 April 2015
ENGLISH only

**RESPONSE TO THE DIRECTOR-GENERAL'S REQUEST TO THE
SCIENTIFIC ADVISORY BOARD TO PROVIDE FURTHER ADVICE ON
ASSISTANCE AND PROTECTION**

SCIENCE FOR DIPLOMATS

**THE SCIENCE OF MEDICAL
COUNTERMEASURES**

Wednesday 8 July 2015
13:30 - 15:00
Ooms Room

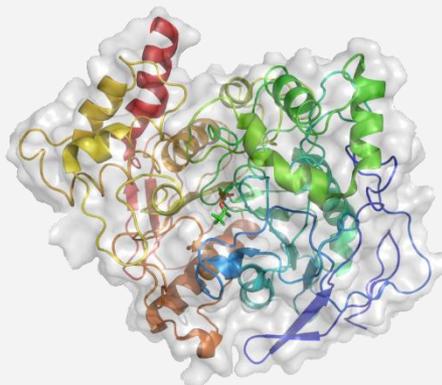
Light lunch will be available at 13:00



ORGANISATION FOR THE PROHIBITION
OF CHEMICAL WEAPONS

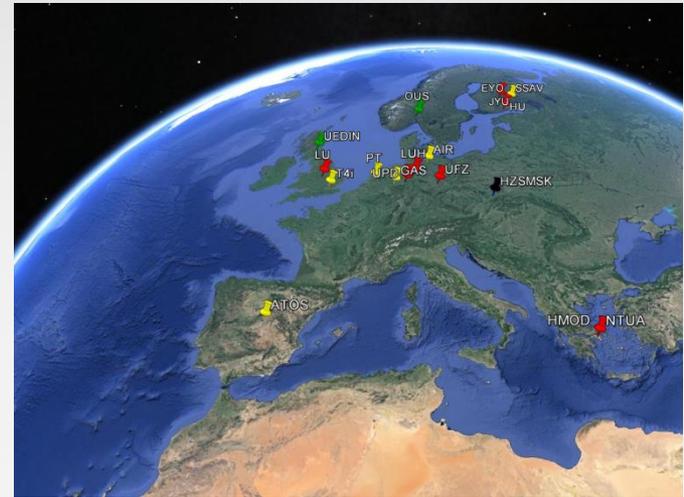
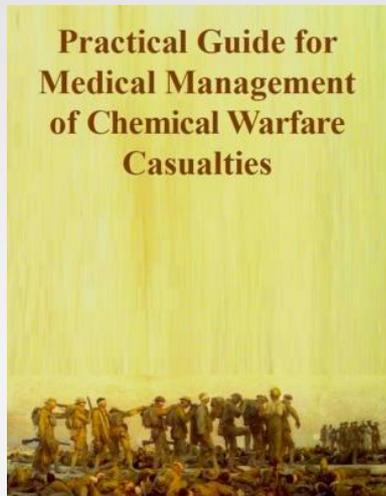
Advice has focused on treating short-term acute symptoms of nerve agent poisoning but not long-term effects

Diagnosis and management of the late effects of nerve agent exposure was discussed during SAB-23





Assistance and protection



www.toxi-triage.eu

Integrated and adaptive responses to toxic emergencies for rapid triage : engineering a roadmap from casualty to patient to survivor





SAB workshops in 2016

Chemical forensics relevant to the CWC

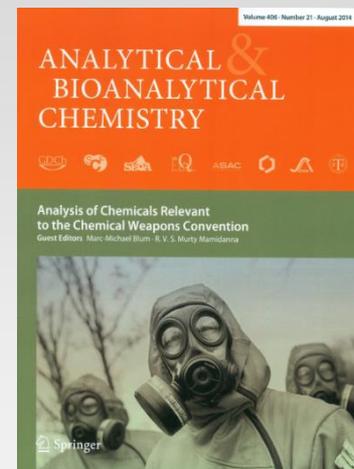
Helsinki – June 2016

VERIFIN, University of Helsinki

Chemical warfare agent toxicity, emergency response and medical countermeasures

Paris – 26-27 September 2016

French General Secretariat for Defense and National Security





Other SAB work in 2016

Spiez CONVERGENCE II

Spiez - 5-8 September

Spiez Laboratory, Switzerland



SAB-24

OPCW – 25-28 October



BWC Eighth Review Conference

Geneva – 7-11 November

United Nations Office Geneva



