



OPCW

Organisation for the Prohibition of Chemical Weapons

Scientific Advisory Board Recommendations to the Fourth Review Conference

*Presented to
Industry Cluster
The Hague, 9 July 2018*

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Science and Technology in the Convention

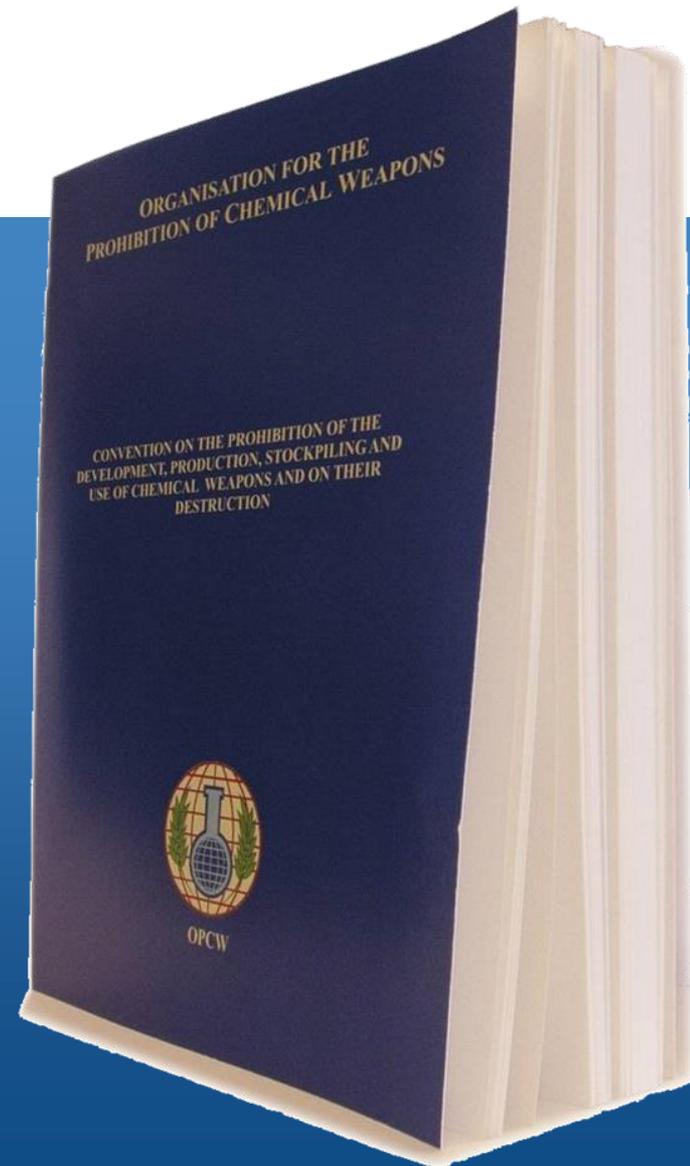
The Conference of States Parties Shall:

“Review scientific and technological developments that could affect the operation of this Convention and, in this context, direct the Director General to establish a Scientific Advisory Board to enable him, in the performance of his functions, to render specialized advice in areas of science and technology relevant to this Convention, to the Conference, the Executive Council or States Parties.”

- Article VIII, Section B, paragraph 21(h)



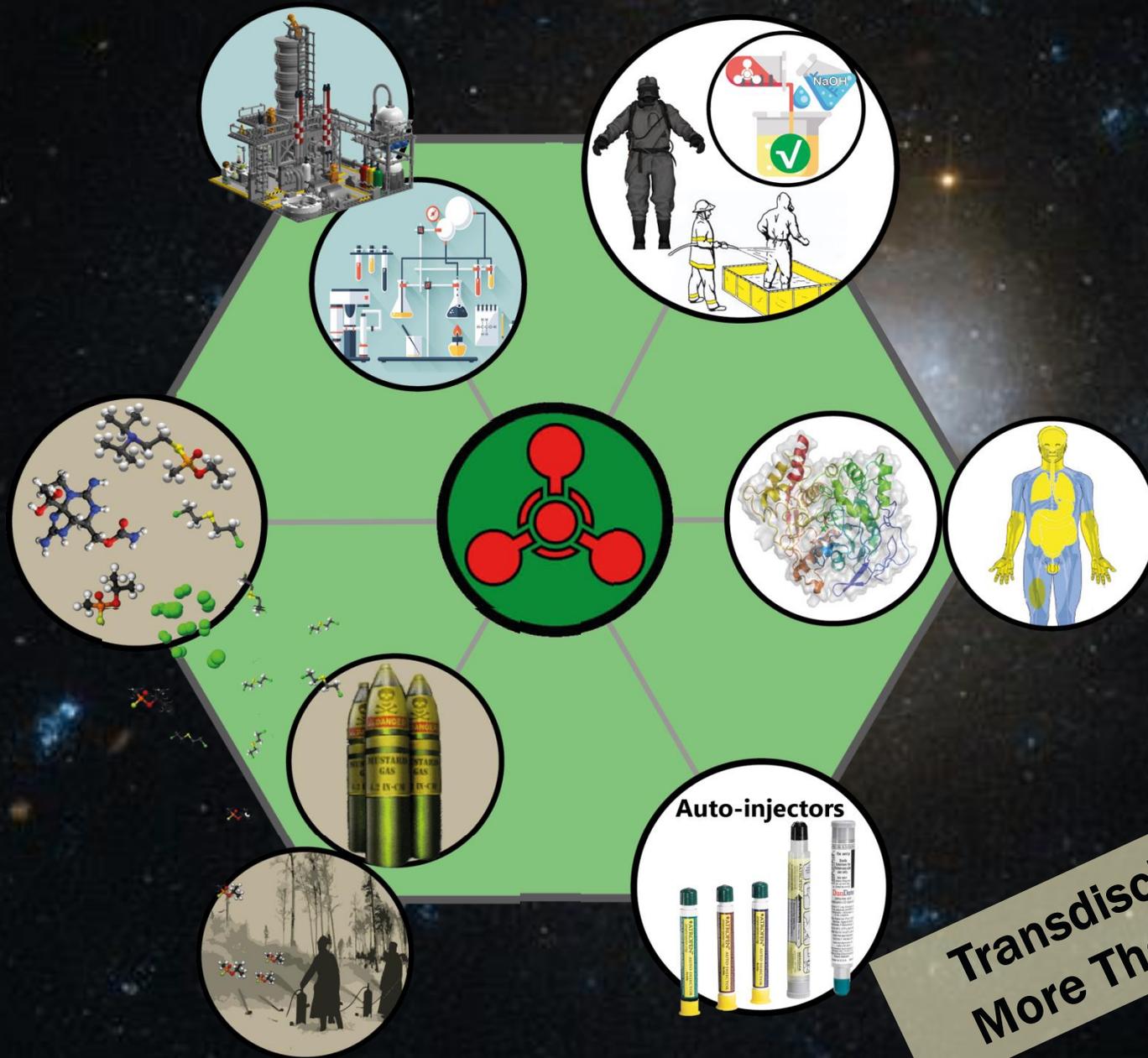
OPCW



Science is vast...



Science is vast...

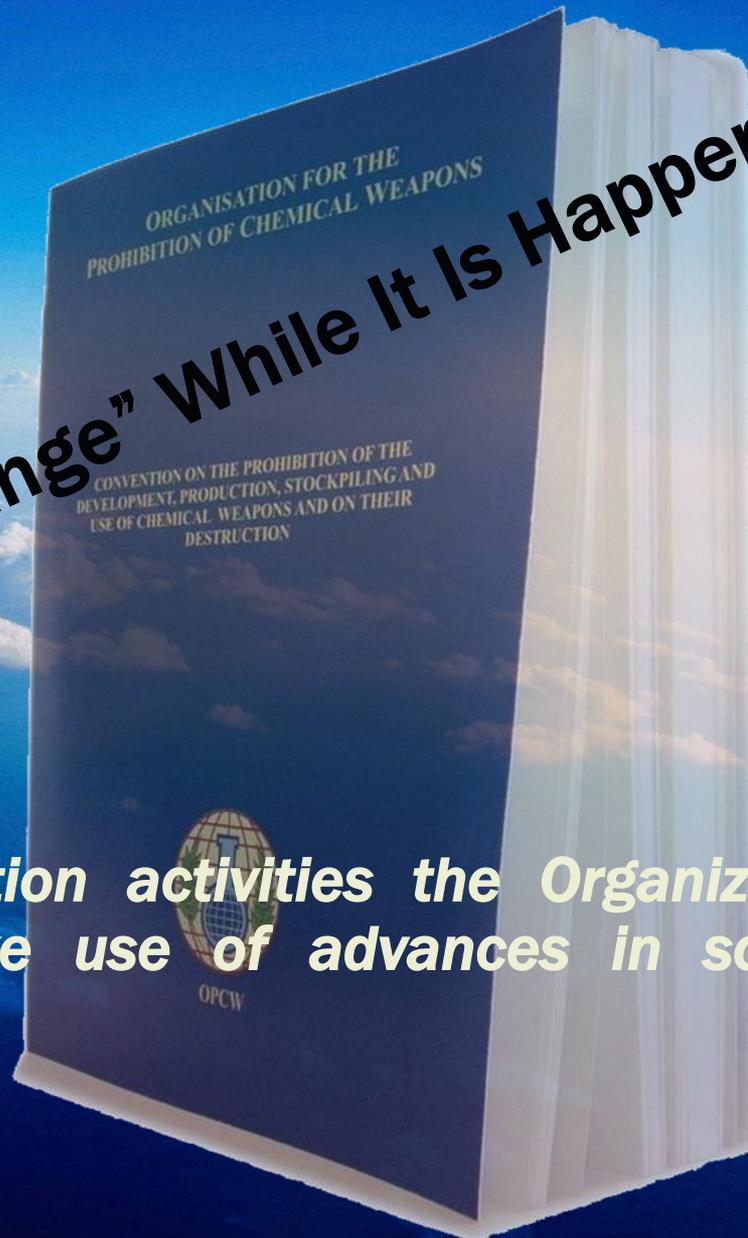


**Transdisciplinary and
More Than Chemicals**

We Cannot Afford to be Afraid...



Recognize "Change" While It Is Happening....



"In undertaking its verification activities the Organization shall consider measures to make use of advances in science and technology"

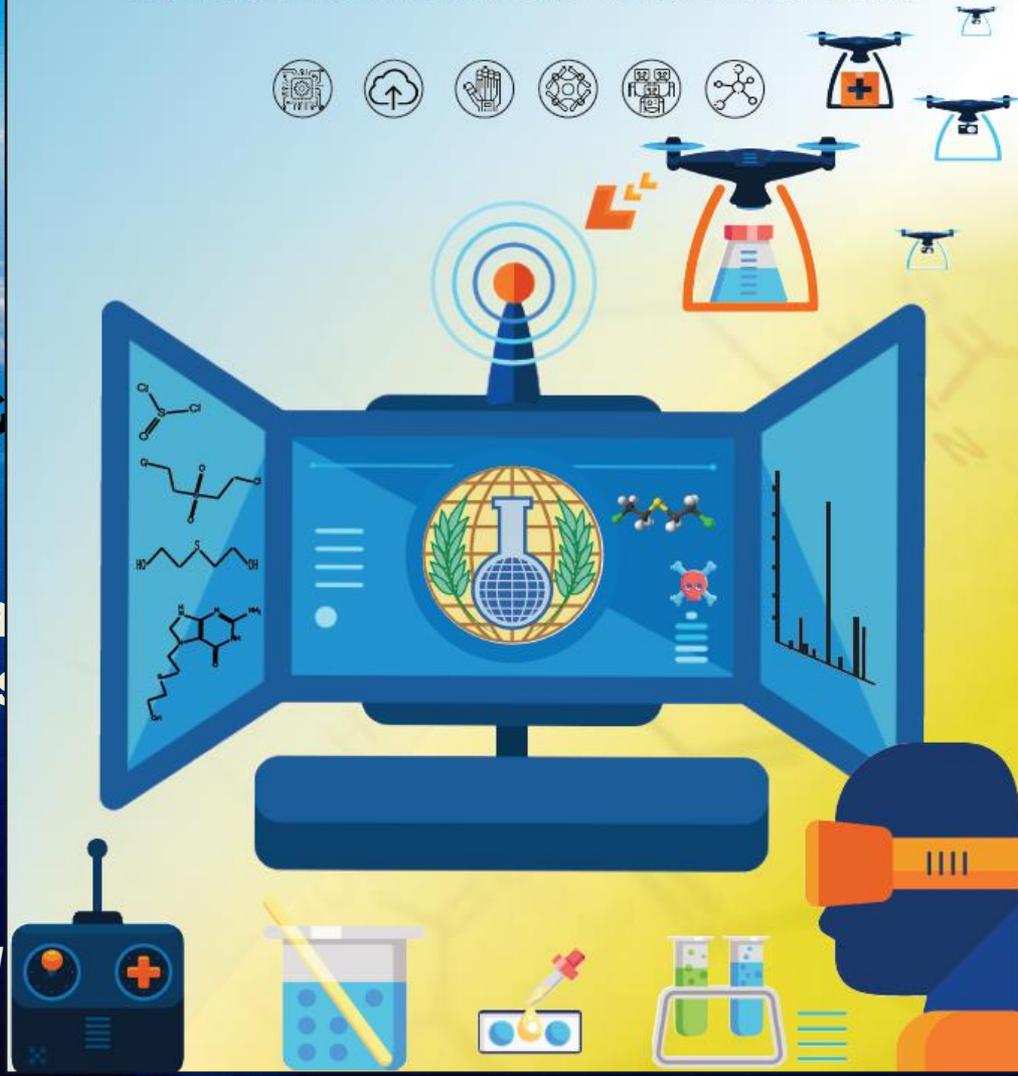
- **CWC Article VIII, paragraph 6**

Innovation

and

the Chemical Weapons Convention

Scientific Review for an International Disarmament Treaty



... happening....

Rec

"In undertaking
consider meas
technology"

Organization shall
in science and

- CWC Article VI

Inputs for the Scientific Advisory Board's Report

CONVERGENCE OF CHEMISTRY AND BIOLOGY

REPORT OF THE SCIENTIFIC ADVISORY BOARD'S TEMPORARY WORKING GROUP

JUNE 2014



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS



VERIFICATION

REPORT OF THE SCIENTIFIC ADVISORY BOARD'S TEMPORARY WORKING GROUP



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

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 readily be developed and/or adapted 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 investigations (data, materials, collected, analyzed, and individuals interviewed)?

Question 3: What are the best practices for management of data collected in investigations, including compilation, storage, and analysis?

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 novel) allow point-of-care and non-destructive measurements in an investigative site to help guide evidence collection?

Question 6: Which technologies and methodologies (whether established or novel) can be used in the preservation 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 novel) 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 novel) 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.

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  /opcwonline
  /opcwonline
  /company/opcw
  /photos/opcw
  /opcw

Inputs for the Scientific Advisory Board's Report



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Inputs for the Scientific Advisory Board's Report



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Twenty-first Session
23 - 27 June 2014

RESPONSIBLE
SCIENTIFIC

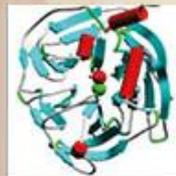
EXECUTIVE

1. Respon...
2. Th...



Chemical Forensics: Capabilities across the Field and the Potential Applications in Chemical Weapons Convention Implementation

Helsinki, Finland. 20 to 22 June 2016
SAB-24/WP.1, dated 14 July 2016, URL: <http://q-r.to/bap1gy>
Coorganizer: VERIFIN



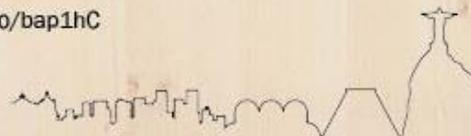
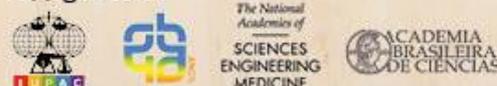
Chemical Warfare Agents: Toxicity, Emergency Response and Medical Countermeasures

Paris, France. 26 to 27 September 2016
SAB-24/WP.2, dated 14 October 2016, URL: <http://q-r.to/bap1h4>
Coorganizer:



Innovative Technologies for Chemical Security

Rio de Janeiro, Brazil. 3 to 5 July 2017
SAB-26/WP.1, dated 21 July 2017, URL: <http://q-r.to/bap1hC>
Coorganizers:



International Workshop on Trends in Chemical Production

Zagreb, the Republic of Croatia. 3 to 5 October 2017
SAB-26/WP.2, dated 19 October 2017, URL: <http://q-r.to/bap1hD>
Coorganizers:



OPCW

(b) ...
CS-2016-978(E) distributed 26/05/2016

1.4 The list of ...
point of reference ...
1 May 2014). The addition ...
(Appendix 5) might also be provided ...
the criteria of an RCA (and thus should not ...
been considered for use as an RCA.

1.5 This original list of 59 has been reviewed and an additional chem... (pipetime) that ...
meets the inclusion criteria was identified. This chemical does not meet the definition ...
of an RCA and is included at the end of the table of Appendix 5.

Available at www.opcw.org/fileadmin/OPCW_serve/2017/06/17-2014_e.pdf

Inputs for the Scientific Advisory Board's Report



Chemical Forensics: Capabilities across the Field and the Potential Applications in Chemical Weapons Convention Implementation

Helsinki, Finland. 20 to 22 June 2016

SAB-24/WP.1, dated 14 July 2016, URL: <http://q-r.to/bap1gy>

Coorganizer: VERIFIN



27 Events

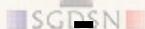


Chemical Weapons Agents: Toxicity, Emergency Response, and Medical Countermeasures

Paris, France. 21 to 23 September 2016

SAB-24/WP.2, dated 14 October 2016, URL: <http://q-r.to/bap1gy>

Coorganizer:



- 289 individuals



- 58 Nationalities



Innovative Technologies in Chemical Forensics

Rio de Janeiro, Brazil. 3 to 5 July 2017

SAB-26/WP.1, dated 21 July 2017, URL: <http://q-r.to/bap1hC>

Coorganizers:



453 Speakers

- 201 individuals

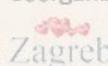


International Workshop on Chemical Products

Zagreb, the Republic of Croatia. 13 to 15 October 2017

SAB-26/WP.2, dated 19 October 2017, URL: <http://q-r.to/bap1hD>

Coorganizers:



32 Reports



Engagement in Scientific Communities



Twenty-first Session
23 - 27 June 2014

RESPONSE
SCIENTIFIC

EXECUTIVE

1. Response

2. The



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CS-2016-9789(E) distributed 20/05/2016

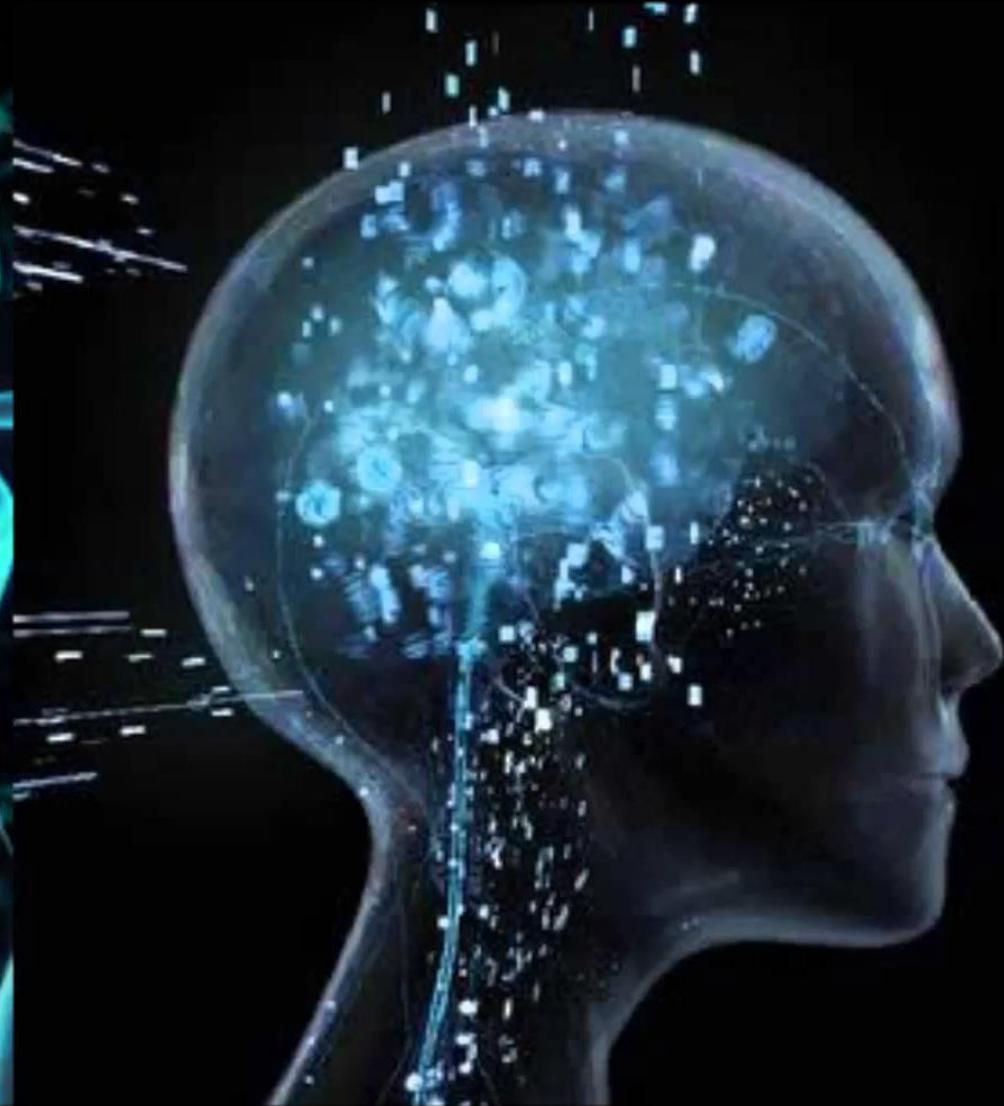
1.4 The list of 11 points of reference (Appendix 5) dated 1 May 2014 is not meet historically

1.5 This original list of 59 has been reviewed and an additional chemical (pipерidine) that meets the inclusion criteria was identified. The chemical does not meet the definition of an RCA and is included at the end of the table of Appendix 5.

Available at www.opcw.org/fileadmin/OPCW_ses2016/05-117-2014_e.pdf

Advances in Science and Technology

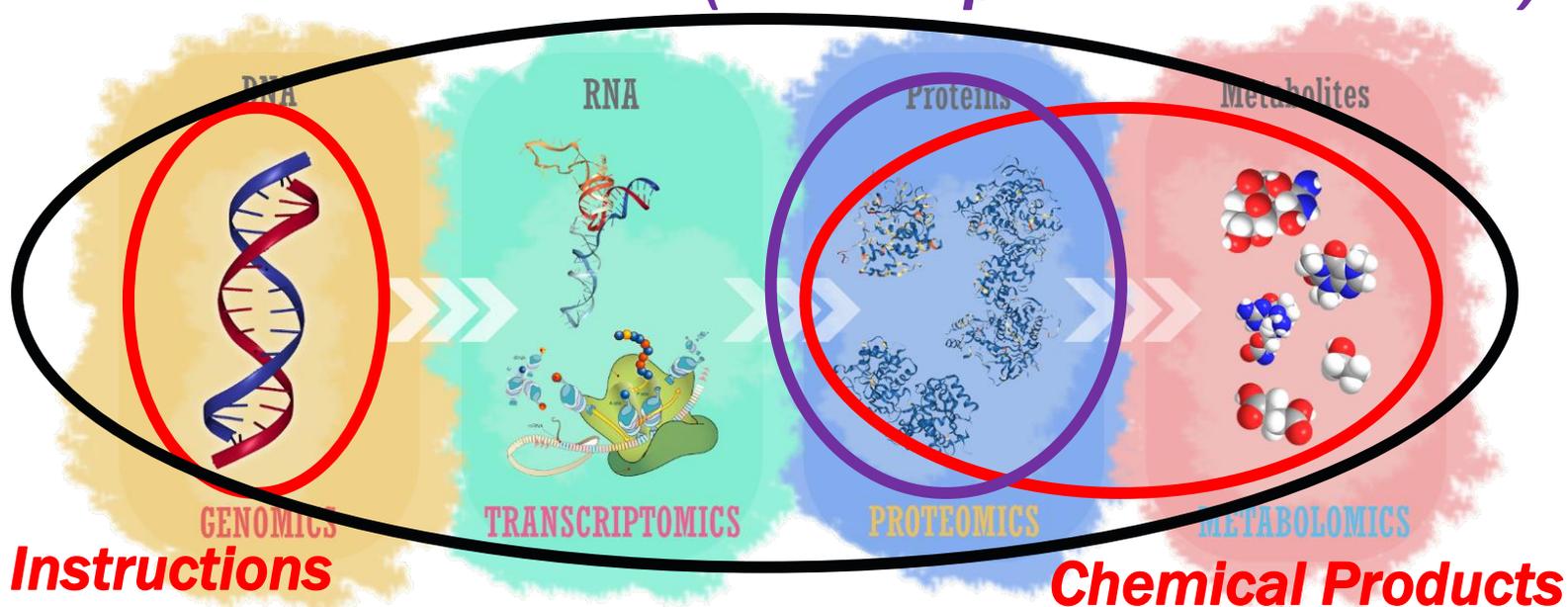
(RC-4/DG.1, paragraphs 16-23)



Convergence of Chemistry and Biology

- Given the potential impact on the Convention of the convergence of chemistry and biology, the SAB and Secretariat should keep under review developments in **biotechnologies**, as well as any other related aspects it deems relevant to the Convention, and report on their implications for the Convention.

“Molecular Devices” (for example: decontaminants)



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Biomarkers of exposure
Targets for medical countermeasures

“Biology” and the Convention

- **Engagement with experts from Biological Weapons Convention**
 - *Share experience - support science assessment - common needs and concerns*
- **Biological and/or biomediated processes do not currently appear likely to be suitable for production of traditional chemical warfare agents**
 - *The field is continually changing, advances should be monitored*
- **“...any process designed for the formation of a chemical substance should be covered by the term “produced by synthesis”**
 - *Degree of relevance of facilities to the object and purpose of the Convention?*
 - *Declarations? OCPFs?, thresholds? Exemptions?*

Advice on chemical production and verification encompass further views relevant to biomediated processes, these could be considered collectively



“Convergence” and the Convention

- ***“...technological change is best considered from a practical perspective, focusing on capabilities relevant to the Convention, irrespective of scientific discipline”***
 - *Consider opportunities from new technologies and technological capabilities that can benefit the Secretariat and assist States Parties in improving their own capabilities.*
- **Technical fields of increasing relevance to the Convention:**
 - *computational chemistry, Big Data, informatics and artificial intelligence, forensic science, remote sensing, and unmanned automated systems.*
- **Adopt a systematic approach to **continued professional development of Secretariat technical experts** to ensure that they possess the knowledge and expertise to identify, evaluate, and apply relevant scientific and technological advances**

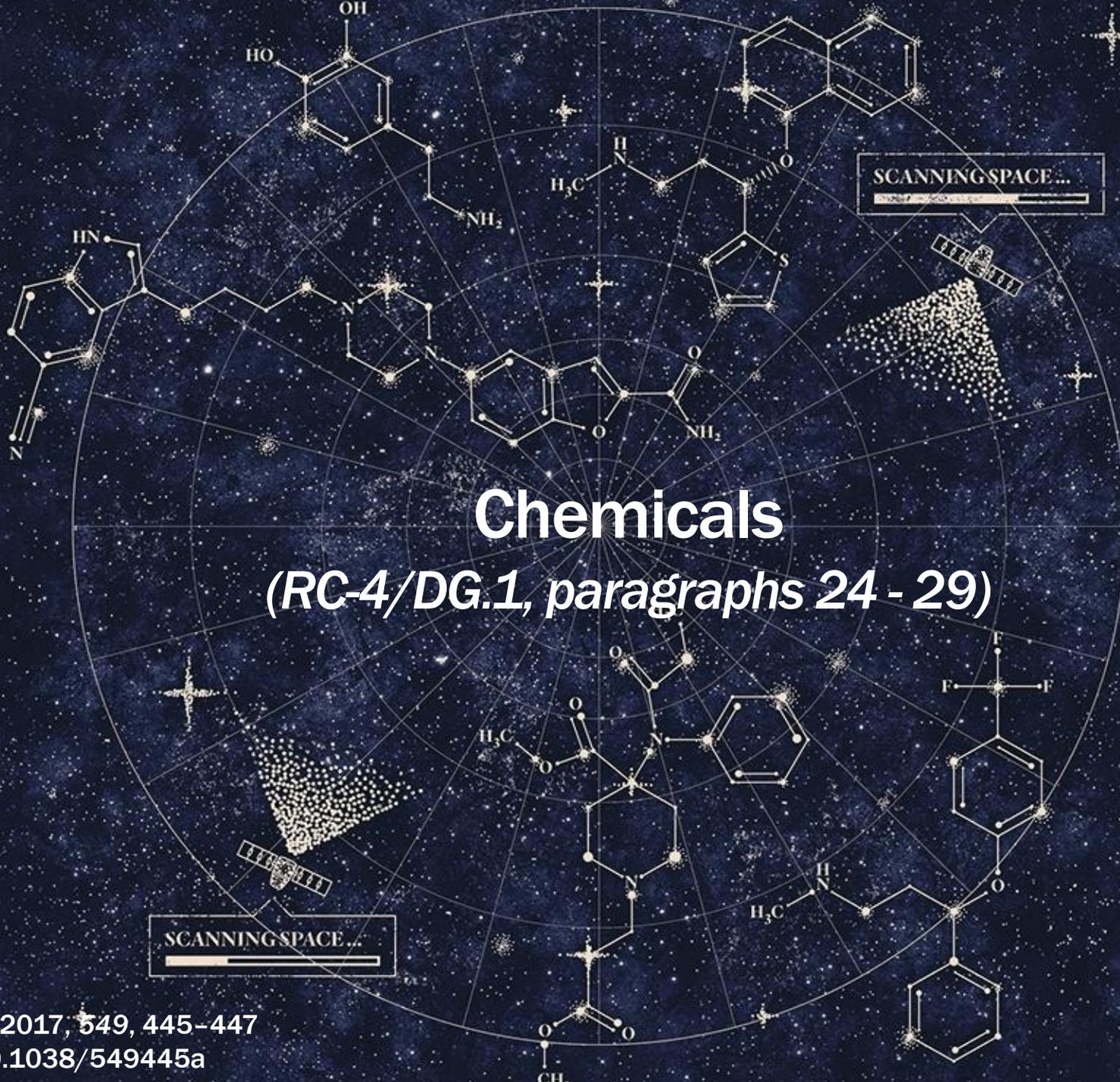


From Director-General's Response (RC-4/DG.2)

Advances in Science and Technology

- In regard to assisting States Parties in improving their own scientific and technological capabilities, as well as in the sharing of scientific knowledge, **the Director-General encourages States Parties to carefully assess their own unique needs and expertise.** Understanding these needs allows identification of relevant scientific communities in which discussion could be initiated. The Secretariat could then draw upon the SAB's scientific review and its own engagement with scientific communities to facilitate useful connections. *RC-4/DG.2, paragraph 9*





Chemicals

(RC-4/DG.1, paragraphs 24 - 29)

Scheduled Chemicals under the Chemical Weapons Convention (CWC)

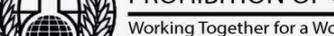
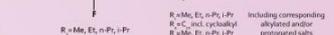
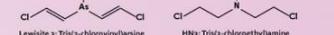
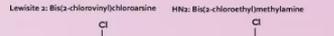
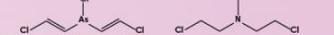
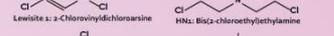
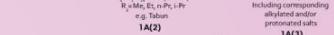
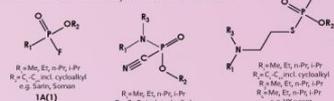
Schedule 1

Guidelines for Schedule 1

The following criteria shall be taken into account in considering whether a toxic chemical or precursor should be included in Schedule 1:

- It has been developed, produced, stockpiled or used as a chemical weapon as defined in Article II;
- It poses otherwise a high risk to the object and purpose of this Convention by virtue of its high potential for use in activities prohibited under this Convention because one or more of the following conditions are met:
 - It possesses a chemical structure closely related to that of other toxic chemicals listed in Schedule 1, and has, or can be expected to have, comparable properties;
 - It possesses such lethal or incapacitating toxicity as well as other properties that would enable it to be used as a chemical weapon;
 - It may be used as a precursor in the final single technological stage of production of a toxic chemical listed in Schedule 1, regardless of whether this stage takes place in facilities, in munitions or elsewhere;
- It has little or no use for purposes not prohibited under this Convention.

Schedule 1 Part A, Toxic Chemicals



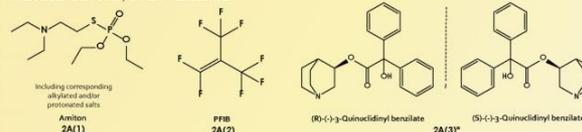
Schedule 2

Guidelines for Schedule 2

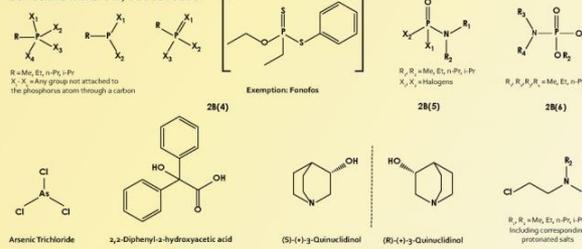
The following criteria shall be taken into account in considering whether a toxic chemical not listed in Schedule 1 or a precursor to a Schedule 1 chemical or to a chemical listed in Schedule 2, part A, should be included in Schedule 2:

- It poses a significant risk to the object and purpose of this Convention because it possesses such lethal or incapacitating toxicity as well as other properties that could enable it to be used as a chemical weapon;
- It may be used as a precursor in one of the chemical reactions at the final stage of formation of a chemical listed in Schedule 1 or Schedule 2, part A;
- It poses a significant risk to the object and purpose of this Convention by virtue of its importance in the production of a chemical listed in Schedule 1 or Schedule 2, part A;
- It is not produced in large commercial quantities for purposes not prohibited under this Convention.

Schedule 2 Part A, Toxic Chemicals



Schedule 2 Part B, Precursors



Schedule 3

Guidelines for Schedule 3

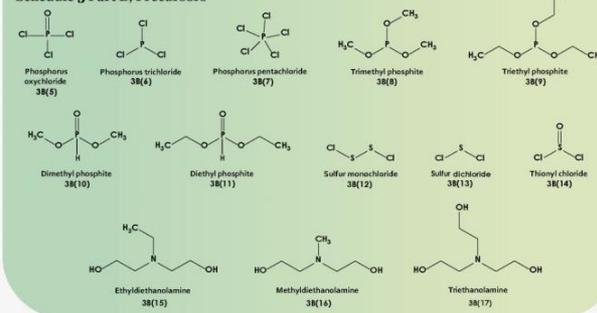
The following criteria shall be taken into account in considering whether a toxic chemical or precursor, not listed in other Schedules, should be included in Schedule 3:

- It has been produced, stockpiled or used as a chemical weapon;
- It poses otherwise a risk to the object and purpose of this Convention because it possesses such lethal or incapacitating toxicity as well as other properties that might enable it to be used as a chemical weapon;
- It poses a risk to the object and purpose of this Convention by virtue of its importance in the production of one or more chemicals listed in Schedule 1 or Schedule 2, part B;
- It may be produced in large commercial quantities for purposes not prohibited under this Convention.

Schedule 3 Part A, Toxic Chemicals



Schedule 3 Part B, Precursors

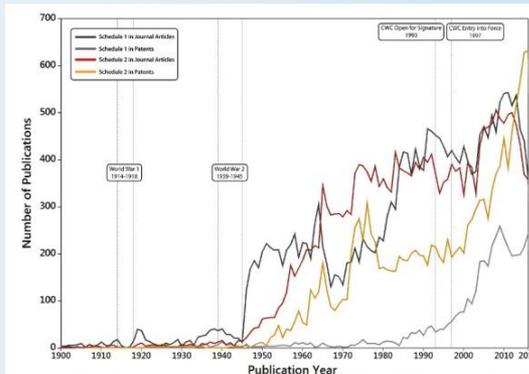
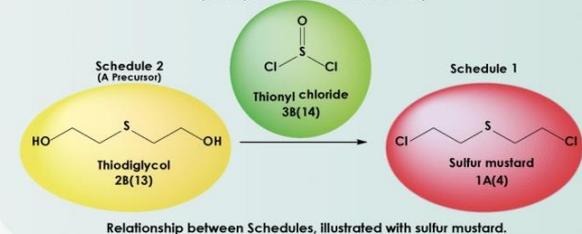


ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Working Together for a World Free of Chemical Weapons



Schedule 3 (Used in production of Schedule 1 chemicals)



Scheduled chemicals, including those in schedules 1 and 2, can have scientifically and economically important uses. This chart captures the number of yearly scientific publications that refer to them.

Scheduled Chemicals under the Chemical Weapons Convention (CWC)

Schedule 1

Guidelines for Schedule 1

The following criteria shall be taken into account in considering whether a toxic chemical or precursor should be included in Schedule 1:

- (a) It has been developed, produced, stockpiled or used as a chemical weapon as defined in Article II;
- (b) It possesses a chemical structure closely related to that of other chemicals listed in Schedule 1, and has, or can be expected to have, comparable properties;
- (c) It possesses such lethal or incapacitating toxicity as well as other properties that it poses otherwise a risk to the object and purpose of this Convention by virtue of its importance in the production of a toxic chemical listed in Schedule 1, regardless of whether this stage takes place in facilities, in munitions or elsewhere;
- (d) It has little or no use for purposes not prohibited under this Convention.

Schedule 2

Guidelines for Schedule 2

The following criteria shall be taken into account in considering whether a toxic chemical not listed in Schedule 1 or a precursor to a Schedule 1 chemical or to a chemical listed in Schedule 2, part A, should be included in Schedule 2:

- (a) It poses a significant risk to the object and purpose of this Convention because it possesses such lethal or incapacitating toxicity as well as other properties that it may be used for purposes of the Convention by virtue of its importance in the production of a chemical listed in Schedule 1 or Schedule 2, part A;
- (b) It poses a significant risk to the object and purpose of this Convention by virtue of its importance in the production of a chemical listed in Schedule 1 or Schedule 2, part A;
- (c) It poses a risk to the object and purpose of this Convention by virtue of its importance in the production of one or more chemicals listed in Schedule 1 or Schedule 2, part B;
- (d) It may be produced in large commercial quantities for purposes not prohibited under this Convention.

Schedule 3

Guidelines for Schedule 3

The following criteria shall be taken into account in considering whether a toxic chemical or precursor, not listed in other Schedules, should be included in Schedule 3:

- (a) It has been produced, stockpiled or used as a chemical weapon;
- (b) It poses otherwise a risk to the object and purpose of this Convention because it possesses such lethal or incapacitating toxicity as well as other properties that might enable it to be used as a chemical weapon;
- (c) It poses a risk to the object and purpose of this Convention by virtue of its importance in the production of one or more chemicals listed in Schedule 1 or Schedule 2, part B;
- (d) It may be produced in large commercial quantities for purposes not prohibited under this Convention.

25 Years Old – Time for a Review?

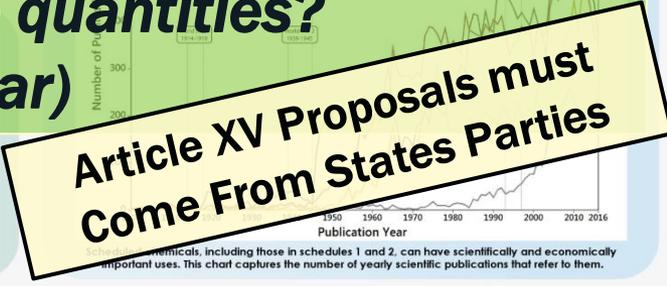
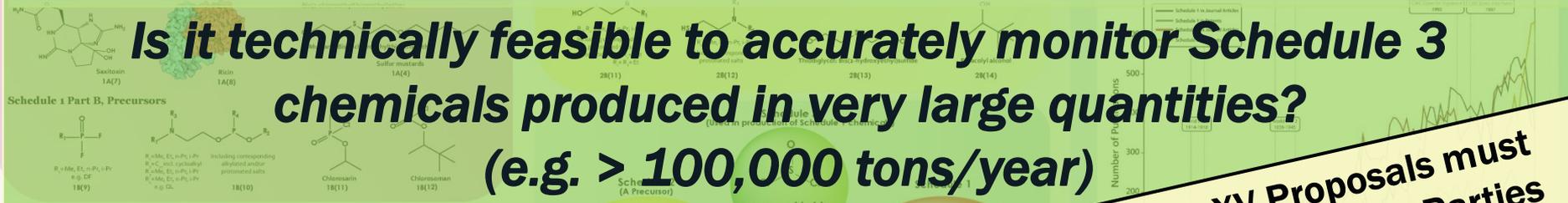
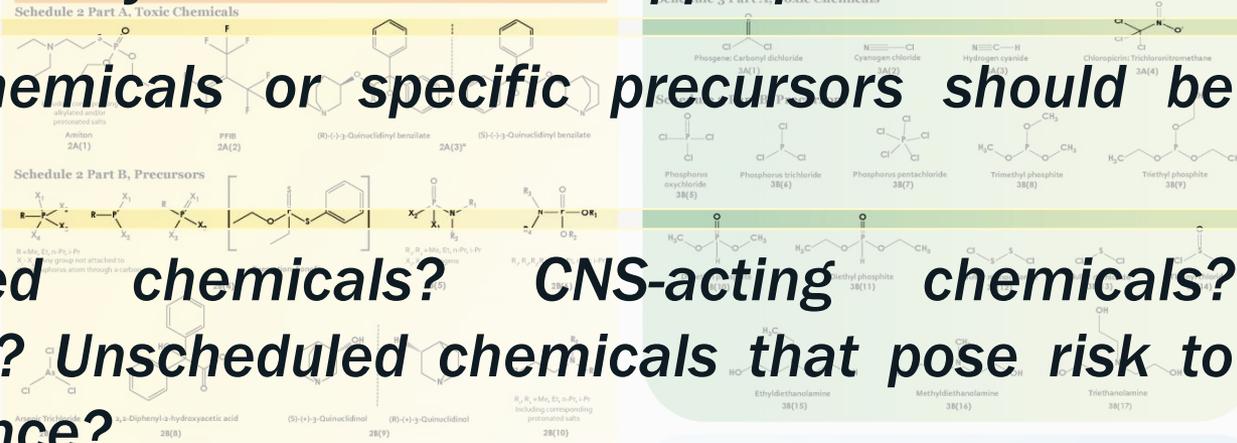
Are the chemicals currently listed in the appropriate schedule?

Should any toxic chemicals or specific precursors be added or removed?

Salts of scheduled chemicals? CNS-acting chemicals? Bioregulators? Toxins? Unscheduled chemicals that pose risk to preventing re-emergence?

Is it technically feasible to accurately monitor Schedule 3 chemicals produced in very large quantities?

(e.g. > 100,000 tons/year)

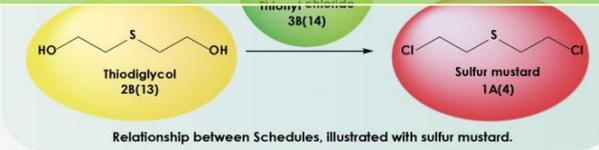


Article XV Proposals must Come From States Parties



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Relationship between Schedules, illustrated with sulfur mustard.

Schedule 3 chemicals, including those in schedules 1 and 2, can have scientifically and economically important uses. This chart captures the number of yearly scientific publications that refer to them.

Scheduled Chemicals under the Chemical Weapons Convention (CWC)

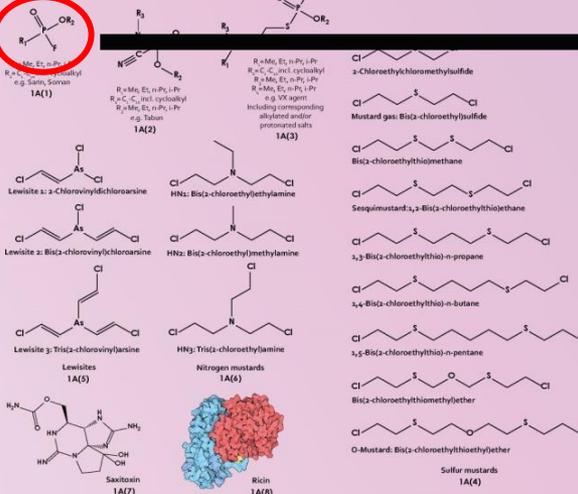
Schedule 1

Guidelines for Schedule 1

The following criteria shall be taken into account in considering whether a toxic chemical or precursor should be included in Schedule 1:

- It has been developed, produced, stockpiled or used as a chemical weapon as defined in Article I;
- It poses otherwise a high risk to the object and purpose of this Convention by virtue of its high potential for use in activities prohibited under this Convention because one or more of the following conditions are met:
 - It possesses a chemical structure closely related to that of other toxic chemicals listed in Schedule 1, and has, or can be expected to have, comparable properties;
 - It possesses such lethal or incapacitating toxicity as well as other properties that would enable it to be used as a chemical weapon;
 - It may be used as a precursor in the final single technological stage of production of a toxic chemical listed in Schedule 1, regardless of whether this stage takes place in facilities, in munitions or elsewhere;
- It has little or no use for purposes not prohibited under this Convention.

Schedule 1 Part A, Toxic Chemicals



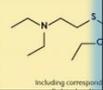
Schedule 1 Part B, Precursors



Guidelines

- It poses otherwise a high risk to the object and purpose of this Convention by virtue of its high potential for use in activities prohibited under this Convention because one or more of the following conditions are met:
 - It possesses a chemical structure closely related to that of other toxic chemicals listed in Schedule 1, and has, or can be expected to have, comparable properties;
 - It possesses such lethal or incapacitating toxicity as well as other properties that would enable it to be used as a chemical weapon;
 - It may be used as a precursor in the final single technological stage of production of a toxic chemical listed in Schedule 1, regardless of whether this stage takes place in facilities, in munitions or elsewhere;
- It has little or no use for purposes not prohibited under this Convention.

Schedule 2 Part A



Schedule 2 Part B



B. SCHEDULES OF CHEMICALS

The following Schedules list toxic chemicals and their precursors. For the purpose of implementing this Convention, these Schedules identify chemicals for the application of verification measures according to the provisions of the Verification Annex. Pursuant to Article II, subparagraph 1 (a), these Schedules do not constitute a definition of chemical weapons.

(Whenever reference is made to groups of dialkylated chemicals, followed by a list of alkyl groups in parentheses, all chemicals possible by all possible combinations of alkyl groups listed in the parentheses are considered as listed in the respective Schedule as long as they are not explicitly exempted. A chemical marked "*" on Schedule 2, part A, is subject to special thresholds for declaration and verification, as specified in Part VII of the Verification Annex.)

Schedule 1

A. Toxic chemicals:

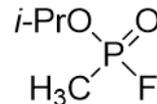
- O-Alkyl ($\leq C_{10}$, incl. cycloalkyl) alkyl (Me, Et, n-Pr or i-Pr)-phosphonofluoridates

e.g. Sarin: O-Isopropyl methylphosphonofluoridate
Soman: O-Pinacolyl methylphosphonofluoridate

(CAS registry number)

(107-44-8)
(96-64-0)

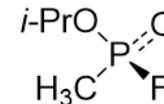
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Sarin

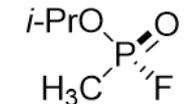
CAS 107-44-8

Schedule 1.A.01



(R)-(-)-Sarin

CAS 6171-94-4



(S)-(+)-Sarin

CAS 6171-93-3

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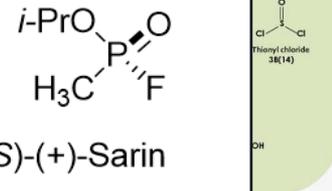
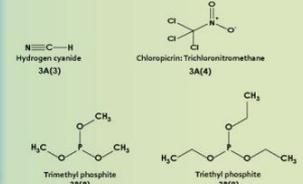
2-Chloroethylchloromethylsulfide
Mustard gas: Bis(2-chloroethyl)sulfide
Bis(2-chloroethylthio)methane
Sesquimustard: 1,2-Bis(2-chloroethylthio)ethane
1,3-Bis(2-chloroethylthio)-n-propane
1,4-Bis(2-chloroethylthio)-n-butane
1,5-Bis(2-chloroethylthio)-n-pentane
Bis(2-chloroethylthio)methyl ether
O-Mustard: Bis(2-chloroethylthio)ethyl ether

There are still more sarin CAS Numbers

Schedule 3

The following criteria shall be taken into account in considering whether a toxic chemical or precursor should be included in Schedule 3:

- It poses otherwise a high risk to the object and purpose of this Convention by virtue of its high potential for use in activities prohibited under this Convention because one or more of the following conditions are met:
 - It possesses a chemical structure closely related to that of other toxic chemicals listed in Schedule 1, and has, or can be expected to have, comparable properties;
 - It possesses such lethal or incapacitating toxicity as well as other properties that would enable it to be used as a chemical weapon;
 - It may be used as a precursor in the final single technological stage of production of a toxic chemical listed in Schedule 1, regardless of whether this stage takes place in facilities, in munitions or elsewhere;
- It has little or no use for purposes not prohibited under this Convention.



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS
Working Together for a World Free of Chemical Weapons

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Relationship between Schedules, illustrated with sulfur mustard.

Schedules of Chemicals

Relationship between Schedules, illustrated with sulfur mustard.

important uses. This chart captures the number of yearly scientific publications that refer to them.

Scheduled Chemicals under the Chemical Weapons Convention (CWC)

Schedule 1

Guidelines for Schedule 1

The following criteria shall be taken into account in considering whether a toxic chemical or precursor should be included in Schedule 1:

- (a) It has been developed, produced, stockpiled or used as a chemical weapon as

B. SCHEDULES OF CHEMICALS

The following Schedules list toxic chemicals and their precursors. For the purpose of implementing this Convention, these Schedules identify chemicals for the application of verification measures according to the provisions of the Verification Annex. Pursuant to Article II, subparagraph 1 (a), these Schedules do not constitute a definition of chemical weapons.

Schedule 3

to account in considering whether a toxic other Schedules, should be included in

Chemical Abstracts Service (CAS) Registry Numbers should not be solely relied on to define chemicals covered by the schedules

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



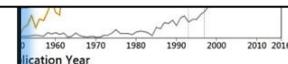
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51 Schedules of Chemicals Relationship between Schedules, illustrated with sulfur mustard.

Schedules of Chemicals



Schedules 1 and 2, can have scientifically and economically important uses. This chart captures the number of yearly scientific publications that refer to them.

Scheduled Chemicals under the Chemical Weapons Convention (CWC)

Schedule 1

Guidelines for Schedule 1

The following criteria shall be taken into account in considering whether a chemical or precursor should be included in Schedule 1:

- (a) It has been developed, produced, stockpiled or used as a chemical weapon.

Schedule 3

precursors. For the purpose of chemicals for the application of the Verification Annex. Schedules do not constitute a

to account in considering whether a toxic other Schedules, should be included in



Chemical Weapons Act 1996

CHAPTER 6

ARRANGEMENT OF SECTIONS

- Introduction*
- Section. 1. General interpretation.
- Chemical weapons*
- 2. Use etc. of chemical weapons.
 - 3. Application of section 2.
 - 4. Suspicious objects.
 - 5. Power to remove or immobilise objects.
 - 6. Power to destroy removed objects.
 - 7. Power to enter premises and destroy objects.
 - 8. Compensation for destruction of objects.
 - 9. Offences relating to destruction etc.
 - 10. Destruction etc: supplementary.
- Chemicals for permitted purposes*
- 19. Restriction on use etc.
 - 20. Licences.
- Information and records*
- 21. Information for purposes of Act.
 - 22. Information and records for purposes of Convention.
 - 23. Identifying persons who have information.

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We Have Seen Examples of National Guidelines Updates to Reflect These Views in some States Parties

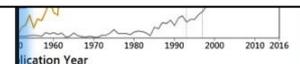


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- opcw

Relationship between Schedules, illustrated with sulfur mustard.

Schedules of Chemicals



important uses. This chart captures the number of yearly scientific publications that refer to them.

Unscheduled Chemicals

- **Develop capabilities to conduct missions involving an alleged use of CNS-acting chemicals for hostile purposes**
 - *Sampling and analysis, OCAD additions*
 - *Technical discussions of CNS acting chemicals within the SAB remain exhausted*



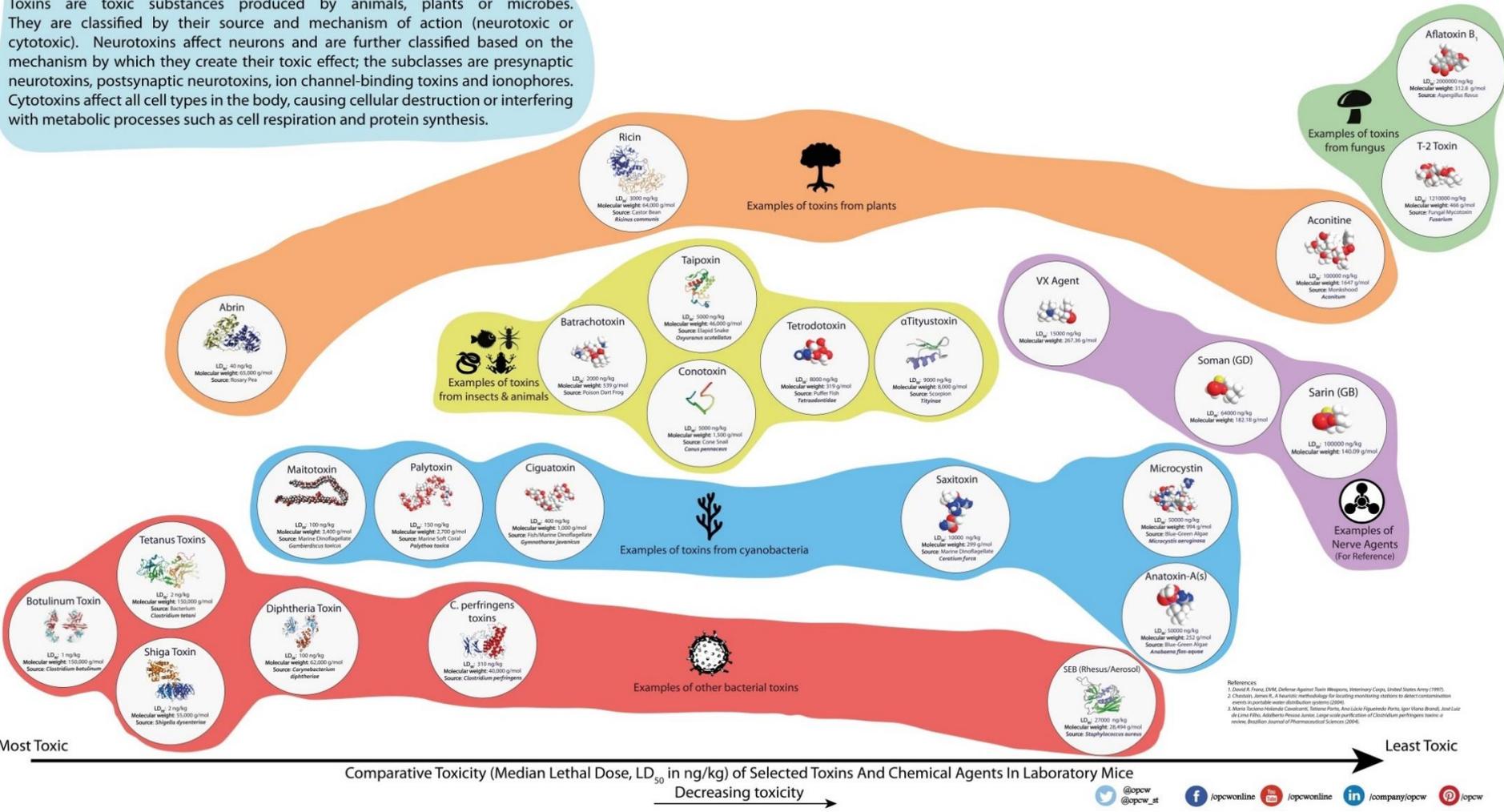
- **In view of the use of toxic industrial chemicals (TICs) as chemical weapons, seek to identify markers that may be formed through reactions with living tissue or materials.**



Toxins

What are Toxins?

Toxins are toxic substances produced by animals, plants or microbes. They are classified by their source and mechanism of action (neurotoxic or cytotoxic). Neurotoxins affect neurons and are further classified based on the mechanism by which they create their toxic effect; the subclasses are presynaptic neurotoxins, postsynaptic neurotoxins, ion channel-binding toxins and ionophores. Cytotoxins affect all cell types in the body, causing cellular destruction or interfering with metabolic processes such as cell respiration and protein synthesis.



References:
 1. David & Franz, DWR, Defense Against Toxin Weapons, Interscience, United States Army (1985)
 2. Chakrabarti, James, R., A neuronal methodology for testing monitoring stations to detect contamination events in portable water distribution systems (2008)
 3. Maria, Luciano, Roberto, Claudio, Roberto, Paulo, Jose, Carlos, Riquelme, Paulo, Igor, Helder, Brand, Joel, Luis de Lima, Fátima, Adelaide, Pires, Denise, Large scale purification of *Clostridium perfringens* toxin a review, Brazilian Journal of Pharmaceutical Sciences (2006)

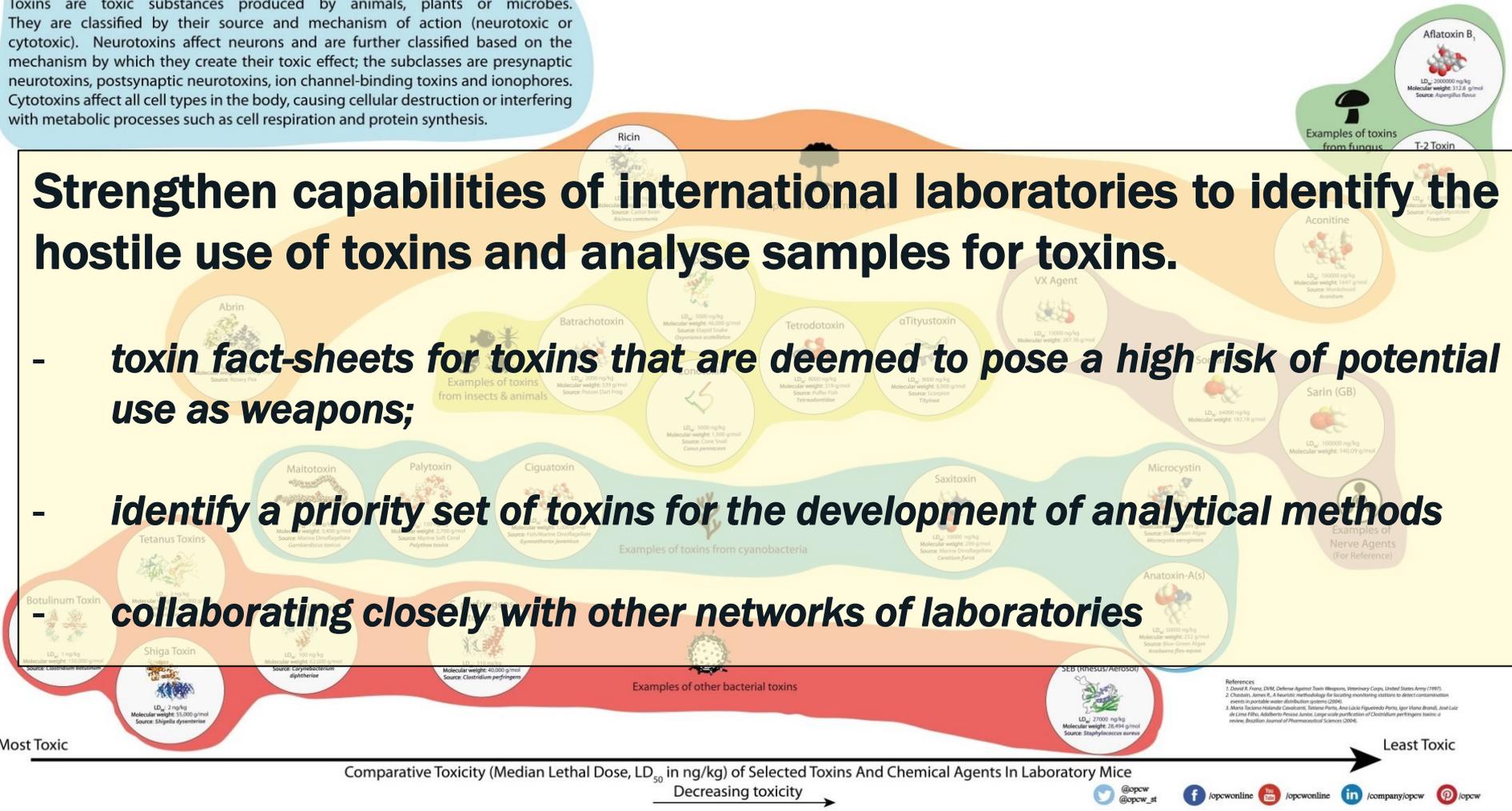
Toxins

What are Toxins?

Toxins are toxic substances produced by animals, plants or microbes. They are classified by their source and mechanism of action (neurotoxic or cytotoxic). Neurotoxins affect neurons and are further classified based on the mechanism by which they create their toxic effect; the subclasses are presynaptic neurotoxins, postsynaptic neurotoxins, ion channel-binding toxins and ionophores. Cytotoxins affect all cell types in the body, causing cellular destruction or interfering with metabolic processes such as cell respiration and protein synthesis.

Strengthen capabilities of international laboratories to identify the hostile use of toxins and analyse samples for toxins.

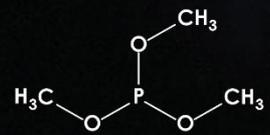
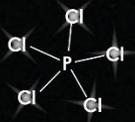
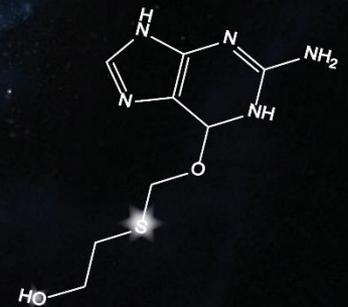
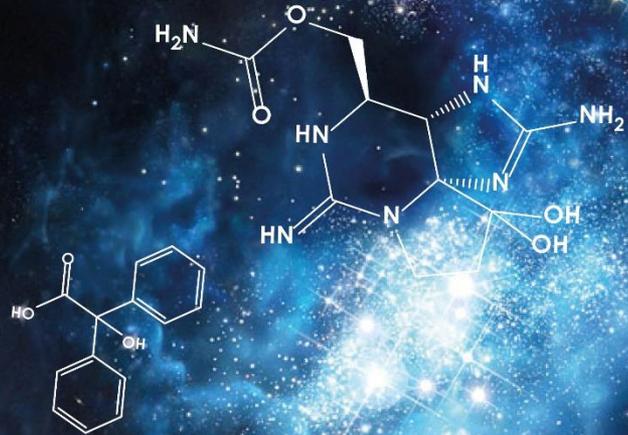
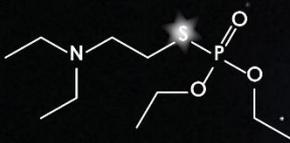
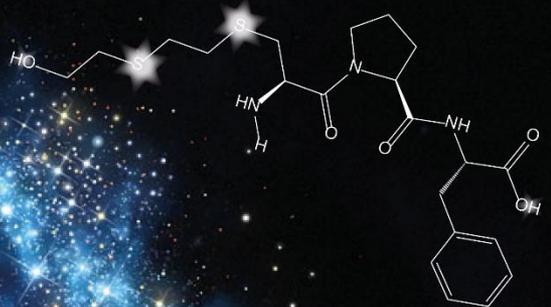
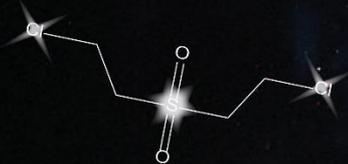
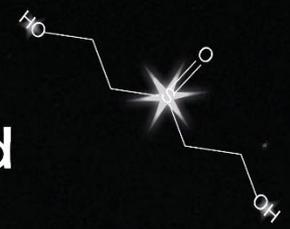
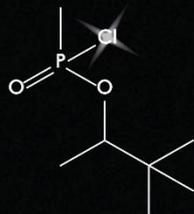
- **toxin fact-sheets for toxins that are deemed to pose a high risk of potential use as weapons;**
- **identify a priority set of toxins for the development of analytical methods**
- **collaborating closely with other networks of laboratories**



References:
 1. David & Franz, DMS, Defense Against Toxin Weapons, Intermory Cases, United States Army (1995)
 2. Chastell, James R., A heuristic methodology for testing monitoring stations to detect contamination events in portable water distribution systems (2006)
 3. Marín, Ismael; Rodríguez, Claudio; Torres, Pedro; José-Luis; Figueredo, Pedro; Igor; Horta; Brandt, José-Luis; de Lima Filho, Adalberto; Pereira, Jairo. Large scale purification of Clostridium perfringens toxin a review. Brazilian Journal of Pharmaceutical Sciences (2006).

Science for Diplomats at EC-88

The Chemical Universe: Scheduled and Unscheduled



Tuesday, 10 July 2018
Ooms Room, OPCW

13:30 - 14:45

Light lunch served at 13:00

Science for Diplomats

The Chemical Universe

Join us tomorrow for a “scientific” review and a “test your knowledge” quiz on the Schedules!

Schedule 1 Chemicals

Guidelines for Schedule 1

The following criteria shall be taken into account in considering whether a toxic chemical or precursor should be included in Schedule 1:

- It has been developed, produced, stockpiled or used as a chemical weapon as defined in Article II;
- It poses otherwise a high risk to the object and purpose of this Convention by virtue of its high potential for use in activities prohibited under this Convention because one or more of the following conditions are met:
 - It possesses a chemical structure closely related to that of other toxic

chemicals listed in Schedule 1, and has, or can be expected to have, comparable properties:

- It possesses such lethal or incapacitating toxicity as well as other properties that would enable it to be used as a chemical weapon;
- It may be used as a precursor in the final single technological stage of production of a toxic chemical listed in Schedule 1, regardless of whether this stage takes place in facilities, in manitrons or elsewhere;
- It has little or no use for purposes not prohibited under this Convention.

<p>1A(1) O-Alkyl (<C10, incl. cycloalkyl) alkyl (Me, Et, n-Pr or i-Pr) phosphonofluoridates</p>	<p>1A(2) O-Alkyl (<C10, incl. cycloalkyl) N,N-dialkyl (Me, Et, n-Pr or i-Pr) phosphoramidocyanidates</p>	<p>1A(4) : Sulfur mustards</p> <p>2-Chloroethylchloromethylsulfide</p> <p>Mustard gas: Bis(2-chloroethyl)sulfide</p> <p>Bis(2-chloroethylthio)methane</p> <p>Sesquimustard: 1,2-Bis(2-chloroethylthio)ethane</p> <p>1,3-Bis(2-chloroethylthio)-n-propane</p> <p>1,4-Bis(2-chloroethylthio) n-butane</p> <p>1,5-Bis(2-chloroethylthio)-n-pentane</p> <p>Bis(2-chloroethylthio)diethyl ether</p> <p>O-Mustard: Bis(2-chloroethylthio)ethyl ether</p>
<p>1A(3) O-Alkyl (H or <C10, incl. cycloalkyl) S,2-dialkyl (Me, Et, n-Pr or i-Pr) aminoethyl alkyl (Me, Et, n-Pr or i-Pr) phosphorothiolates and corresponding alkylated or protonated salts</p>	<p>1A(5) : Lewisites</p> <p>Lewisite 1: 2-Chlorovinylchloroarsine</p> <p>Lewisite 2: Bis(2-chlorovinyl)chloroarsine</p> <p>Lewisite 3: Tris(2-chlorovinyl)arsine</p>	<p>1A(6) : Nitrogen mustards</p> <p>HN1: Bis(2-chloroethyl)ethylamine</p> <p>HN2: Bis(2-chloroethyl)dimethylamine</p> <p>HN3: Tris(2-chloroethyl)amine</p>

1A(7) : Saxitoxin

1A(8) : Ricin
(Scan the image)

1B(9) Alkyl (Me, Et, n-Pr or i-Pr) phosphonyldi fluorides

1B(11) Chlorosarin
O-isopropyl methylphosphonochloridate

1B(10) O-Alkyl (H or <C10, incl. cycloalkyl) (O,2-dialkyl) (Me, Et, n-Pr or i-Pr) aminoethyl alkyl (Me, Et, n-Pr or i-Pr) phosphonates and corresponding alkylated or protonated salts

1B(12) Chlorosoman
O-Pinacetyl methylphosphonochloridate

Instructions

“Test your schedule knowledge”
Place the molecule on the correct schedule

Single bond: 2.5 cm
Double bond: 3 cm
Triple bond: 2.5 cm
Bond to H: 2 cm

For molecular models:
C: H: O:
N: F: Br:
Cl: S: I:

in Augment app

AUGMENT

OPCW
Organisation for the Prohibition of Chemical Weapons

UN
 OECD
 EU
 OSCE
 AU
 ASEAN
 CARICOM
 ECOWAS
 EURASIAN COUNCIL
 EUROPEAN COUNCIL
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From Director-General's Response (RC-4/DG.2)

Chemicals

- The Director-General wishes to call States Parties' attention to the SAB's **recommendation to review the schedules** (paragraph 24 of RC-4/DG.1). *RC-4/DG.2, paragraph 18*
- The Director-General wishes to draw States Parties' attention to the questions posed by the SAB on **whether it is technically feasible to accurately monitor Schedule 3 chemicals that are produced in very large quantities** (for example, over 100,000 metric tonnes per year). *RC-4/DG.2, paragraph 20*
- **CNS Acting Chemicals:** The SAB Chairperson had presented the compiled outcomes of the Board's deliberations on this topic to States Parties at a side event in the margins of the Twenty-Second Session of the Conference of the States Parties, in 2017. **States Parties are encouraged to review this advice** to gain insight for further discussion at the Fourth Review Conference. *RC-4/DG.2, paragraph 22*



Chemical Production and Chemical Discovery

(RC-4/DG.1, paragraphs 30-33)

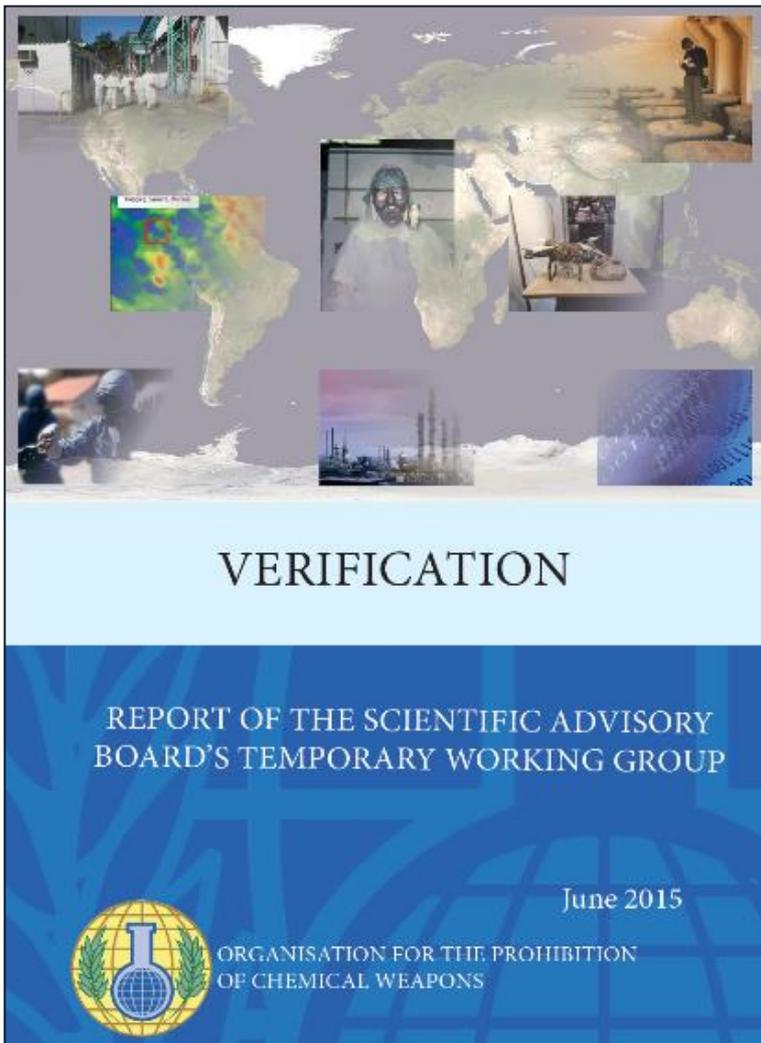


Chemical Production and Chemical Discovery

(RC-4/DG.1, paragraphs 30-33)



Building off of the TWG Report on Article VI Verification



- Verification could benefit from **risk assessment** tools and practices employed in the chemical industry
 - *specifically those for safer process and product design, and for regulatory compliance*
 - **Consider site relevance**
 - *Review declaration thresholds*
- **Learn from and adopt industry best practices where beneficial**
 - *Maintaining technical relevance, knowledge management*

A Thought Exercise: Relevance of 4 Plant Sites*

Assessing the relevance of individual sites				
Plant site	A	B	C	D
Number of plants	8	1	2	12
Production range	1,000-10,000 t	200-1,000 t	>10,000 t	1,000-10,000t
PSF	Yes (1)	No	No	Yes (1)

**Information
in declaration**



A Thought Exercise: Relevance of 4 Plant Sites*

Assessing the relevance of individual sites

Plant site	A	B	C	D
Process Config.	Continuous/ Batch-dedicated	Batch/ Multipurpose	Continuous	Continuous
Number of plants	8	1	2	12
Production range	1,000-10,000 t	200-1,000 t	>10,000 t	1,000-10,000t
PSF	Yes (1)	No	No	Yes (1)
Main chemical(s) on site	Non-toxic	Non-toxic	Very Toxic TIC, examples of use as CW	Non-toxic
Relevance to CWC	M	H	H	L
Products/chemicals handled on site	Methanol/ Detergents	Fine Chemicals	Chlorine/H ₂ S/ vinyl chloride/ PVC	TFE/HFP/ ETBE/MTBE

Information in declaration

Informal pole



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* Courtesy of B. Whelan, OPCW INS

A Thought Exercise: Relevance of 4 Plant Sites*

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A15	1423	3	2.8	2620

Information in declaration

Informal pole

Higher number
Higher relevance ?



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* Courtesy of B. Whelan, OPCW INS

Recommendation from RC-4/DG.1 Annex

- “...verification thresholds for OCPFs 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.” *Sub-paragraph 132(b)*

- “The Secretariat could reassess which **product group codes are highly relevant to the Convention. Facilities declared with these product group codes would be subject to a higher probability to be selected for inspection** (which is consistent with the approach used in the A15 site selection algorithm). For facilities in product group codes that are considered less relevant, the Secretariat should identify appropriate mechanisms to augment the declared information with validated and credible sources to allow for an assessment regarding the need for on-site inspection.” *Subparagraph 132(c)*



From Director-General's Response (RC-4/DG.2) Chemical Production and Chemical Discovery

- **The Fourth Review Conference might consider biomediated processes as part of a larger review of the Article VI verification regime.** Such a review might explore the utility of risk-based approaches to verification (paragraph 30 of RC-4/DG.1), as well as previous SAB recommendations that have not been taken forward, such as:
 - **exemption of certain other chemical production facilities (OCPFs)** from declaration requirements (recommendation 9a of the TWG on Verification);
 - **review and reassessment of the impact of the product group codes** in the OCPF site-selection methodology (recommendation 9b of the TWG on verification); and
 - **revision of verification thresholds for certain OCPFs** (recommendation 10 of the TWG on verification; see also paragraph 33 of RC-4/DG.1).

RC-4/DG.2, paragraph 14



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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.



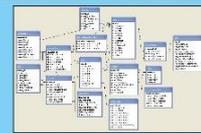
Recommendation 2

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 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 outcomes of such visits may impact on the inspection frequency.



Recommendation 7

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



Recommendation 8

The Secretariat should ensure that all declarable OCPFs submitted by States Parties include all facilities which fall under the scope of paragraph 11 of Part II of the Annex to the Convention, regardless of their purity level, including DOC or DOC mixtures.



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, including on-site inspection procedures.



Recommendation 10

The verification thresholds for OCPFs 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 and environmental analysis, toxins, etc. Establishing a network of experts for forensic 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 Chemical Weapons in the Syrian Arab Republic, and all other 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.



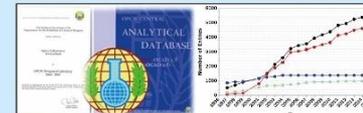
Recommendation 14

The Secretariat should continue to support the development of forensic identification expertise.



Recommendation 15

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



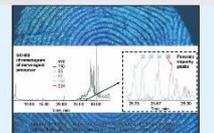
Recommendation 16

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.



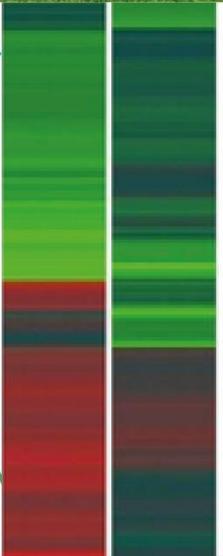
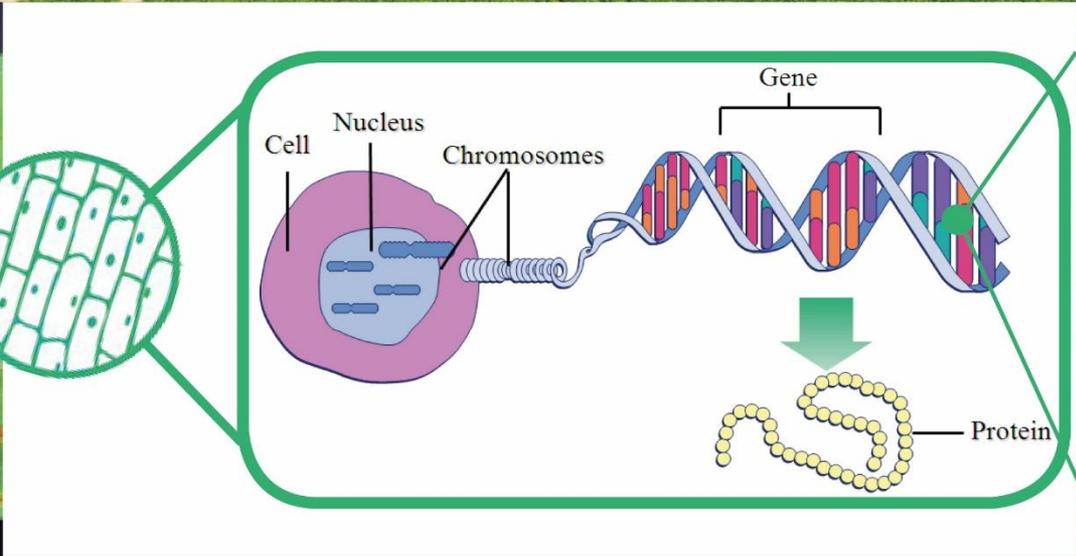
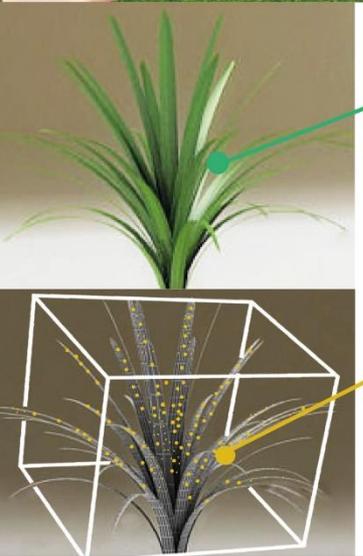
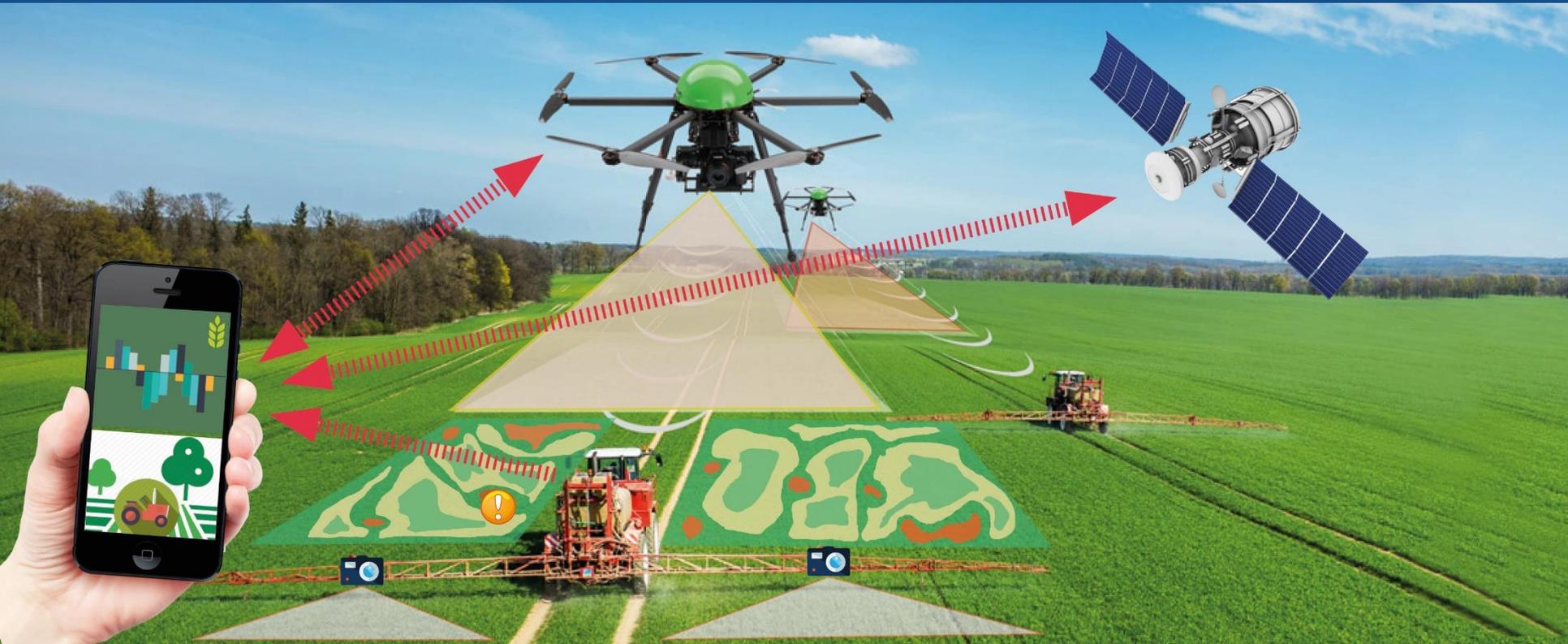
New Advice on Verification (RC-4/DG.1, paragraphs 25 - 47) Building off previous themes with updated perspectives



Continuing from the TWG

- **Effective verification requires assessment of all relevant information pertaining to a site and the State Party, not simply the evaluation of a single inspection.**
 - *Move toward a integrated approach where all of the separate elements of information are combined and analysed systematically*
- **Review Verification Information System (VIS)**
- **Develop new templates for Article VI inspection reports to upload the as a searchable document**
- **Explore possibilities for secure transmission of documents and data between an inspection site and OPCW Headquarters.**





Remote Sensing

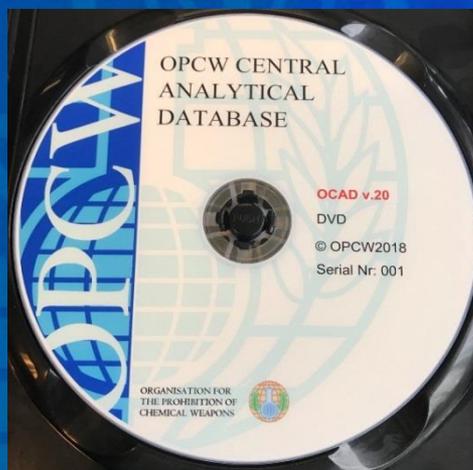
- Satellite imagery has proven useful in planning contingency operations. Secretariat consider cooperating with other international organisations and experts to **enhance capability to interpret and apply satellite information to non-routine operations.**
- Hyperspectral, thermal, and near-infrared imagery may be able to provide **information related to chemical changes** in the imaged area.
- In order to **enable inspection teams to operate in dangerous or remote areas**, the Secretariat should review remote and automated monitoring technologies to identify where their capabilities could be beneficial. Corresponding equipment should be added to the list of approved inspection equipment.



OPCW CENTRAL ANALYTICAL DATABASE

OCAD v.20_2018

January 2018



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

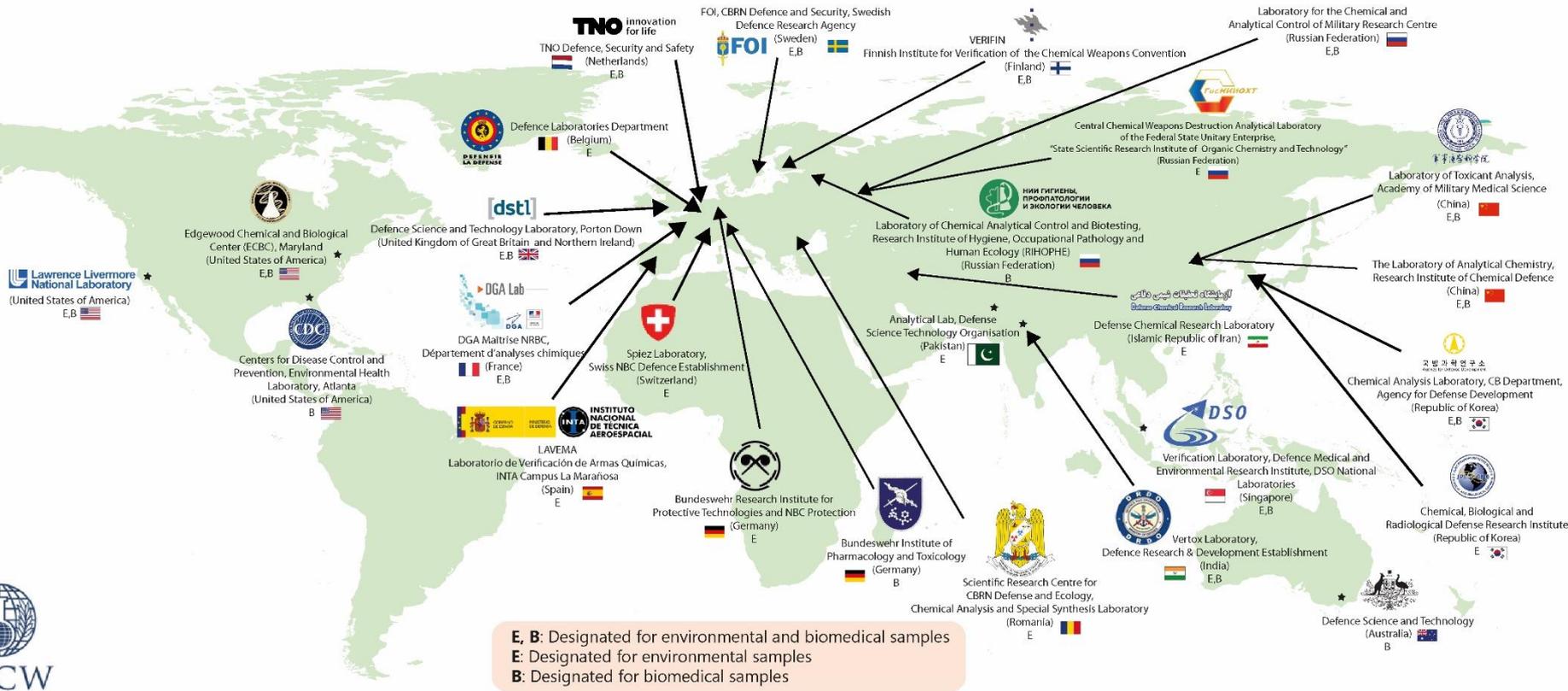
Johan de Wittlaan 32, 2517 JR, The Hague, The Netherlands



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- **Continue adding to OCAD**
 - *Isotopically labelled relatives and stereoisomers of scheduled compounds*
 - *Salts of scheduled compounds*
 - *Toxic industrial chemicals (TICs)*
 - *Riot control agents*
 - *Bioregulators*
 - *Toxins*
 - *Unscheduled chemicals posing a risk to the Convention*

OPCW and Designated Laboratories



OPCW and Designated Laboratories

- Preparedness to analyse operational samples be a factor in maintaining designation and **expand the network both geographically and in terms of capabilities.**
- Support the upgrade of the OPCW Laboratory to a **Centre for Chemistry and Technology. Enhancements to:**
 - *Facilitation of proficiency testing and confidence building exercises*
 - *Support of contingency operations*
 - *Handling and storage of authentic samples*
 - *Provide training*
 - *Scientific visibility to the OPCW*
- Share technical data related to sample analyses conducted for the OPCW among laboratories in the network and **published in peer-reviewed scientific journals**, enabling all laboratories to benefit from proven methods and technologies



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OPCW and Designated Laboratories

Forensic Toxicol
DOI 10.1007/s11419-017-0376-7



CrossMark

ORIGINAL ARTICLE

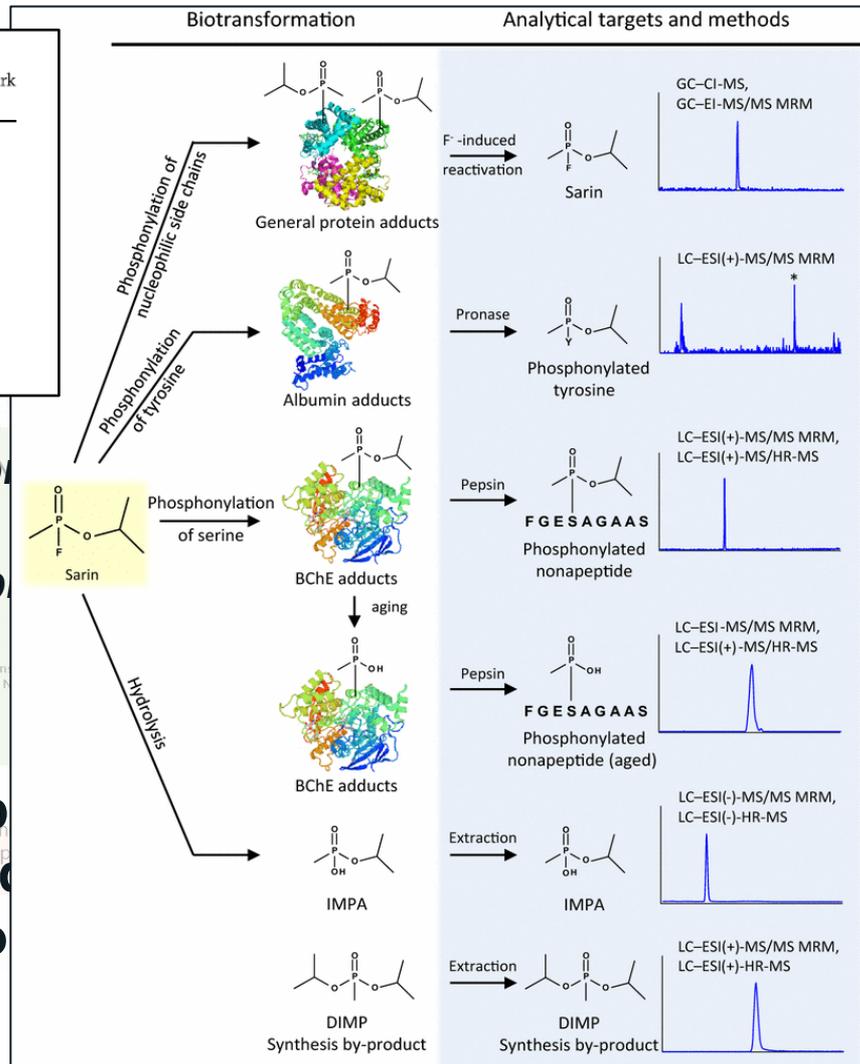
Fatal sarin poisoning in Syria 2013: forensic verification within an international laboratory network

Harald John¹ · Marcel J. van der Schans² · Marianne Koller¹ · Helma E. T. Spruit² · Franz Worek¹ · Horst Thiermann¹ · Daan Noort²

Technology. Enhancements to:

- Facilitation of proficiency testing and control
- Support of contingency operations
- Handling and storage of authentic samples
- Provide training
- Scientific visibility to the OPCW

- Share technical data related to sample analysis among laboratories in the network and scientific journals, enabling all laboratories to benefit from the latest technologies



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Sample and Information Collection, and Analysis

- Strengthen capability to detect and identify traces of **unscheduled toxic chemicals and associated degradation and reaction products**, inter alia, through suitable exercises.
- Encourage further research on potential **biomarkers of exposure to toxic chemicals**. The Engage with experts from a broad range of fields to identify promising analytical approaches.
- The Secretariat, in consultation with relevant experts, should identify such commonly used **forensic techniques** and protocols to assess their applicability for its own activities.

Temporary Working Group to Provide
Further Recommendations



Archiving Samples and Data

- **Maintain a curated collection of reference samples and chemical data**, including compiled data on abandoned chemical weapons, the environmental fate of toxic chemicals, and impurities associated with synthetic routes to nerve and blister agents to support investigative work.
- **Develop a repository of technical information on the environmental impact of legacy chemical weapons** (old, abandoned, and/or sea dumped) in order to facilitate knowledge sharing through the Secretariat. This type of information contains useful data for understanding the environmental fate and transport of chemical warfare agents, which has value for investigative and retrospective analysis.



From Director-General's Response (RC-4/DG.2) Science and Technology Relevant to Verification

- Given the importance of the role of the OPCW Laboratory, the Director-General asks States Parties to **support its upgrade to a Centre for Chemistry and Technology**. *RC-4/DG.2, paragraph 33*
- The Director-General views the sharing of data generated from the work of the OPCW amongst the OPCW designated laboratories as a means to facilitate improved method development and cooperation across the network (paragraph 41 of RC-4/DG.1). The establishment of a repository of chemical data and technical information, and a curated collection of reference samples, could usefully support such method development, as well as provide important reference data on synthetic routes and the environmental fate and transport of chemical warfare agents and other toxic chemicals. The Secretariat is exploring the development of such a repository, which could usefully include information obtained from old and abandoned, as well as sea-dumped, chemical weapons (paragraphs 44 and 45 of RC-4/DG.1). Such information is valuable for review in relation to investigations, assistance missions, and retrospective analysis. The Director-General **encourages States Parties to consider sharing relevant chemical and technical data** in support of such an initiative; the compilation of certain technical information for sharing with States Parties could be an additional benefit of such a repository. *RC-4/DG.2, paragraph 35*



Delivery of Toxic Chemicals and Drugs

(RC-4/DG.1, paragraph 34)



Toxic Chemical Delivery

- The continued development of **unmanned aerial vehicles** (UAVs) to deliver payloads for permitted purposes should be monitored to assess risks of development for chemical weapon delivery purposes.



Height	13 0.2 ± cm
Diameter	26 0.2 ± cm
Gross weight	1.5 ± 0.2 kg
Number of Submunitions	12
Inner projectiles material	Aluminum
Weight of pyrotechnic mixture	400 ± 20 gr
Active agent	20 ± 4 sec
Shelf life	5 years



- While drug delivery advances have been seen, there are practical limitations in crossing them over from controlled physician supervised procedures for wider scale chemical delivery



From Director-General's Response (RC-4/DG.2)

Delivery of Toxic Chemicals and Drugs

- The Director-General wishes to call States Parties' attention to the potential threat raised by the SAB in regard to deploying chemical agents through unmanned systems. He regards the monitoring of developments in this area to be of the utmost importance. Furthermore, the Director-General **encourages States Parties to share their views on associated risks and approaches for mitigation.** *RC-4/DG.2, paragraph 25*



Assistance and Protection

(RC-4/DG.1, paragraph 48)

- In order to enhance OPCW's capability to assist States Parties in response to a chemical weapon attack or incident involving toxic chemicals, the Secretariat should strengthen its preparedness and **monitor advancements in medical countermeasures, detection, physical protection, and decontamination.**

Chemical Safety and Security

(RC-4/DG.1, paragraphs 49 - 51)



**Safety &
Security**



Science and Technology of Relevance to Chemical Safety and Security

- Secretariat encouraged to engage with technical experts to ensure that its **efforts to assist States Parties with chemical safety and security have a sound scientific and technological foundation.**
- Secretariat can **encourage research in chemical security** to prevent toxic chemicals from being acquired by non-State actors with intent to use them as chemical weapons. The **research support programme under Article XI provides a possible mechanism.**
- To assist States Parties, where the economies are either developing or in transition, and that have interest in improving chemical safety and security capabilities, the Secretariat could:
 - *strengthen partnerships and pursue collaborative projects with international organisations engaged in the research and development of technologies for this purpose.*



From Director-General's Response (RC-4/DG.2)

Chemical Safety and Security

■ As concerns about chemical security and the hostile use of chemicals by non-State Actors, including terrorists, continue to rise, States Parties may benefit from the development of technologies and informatics tools that can help to identify and track chemicals, and provide immediate access to critical chemical information. The Director-General **encourages States Parties to review paragraphs 320 to 329 of Annex 1 of RC-4/DG.1 for examples and applications.** The Secretariat will look to incorporate this advice from the SAB into the materials and training it currently provides in the area of chemical safety and security. *RC-4/DG.2, paragraph 39*

■ The Secretariat is reviewing how the existing Article XI programmes can be used to support such engagement, and is considering how it may further engage other organisations and partners in these efforts (paragraphs 50 and 51 of RC-4/DG.1). The Director-General **encourages States Parties to consider their individual needs for chemical safety and security.** This is necessary in order to allow the Secretariat to identify the most effective route for facilitation of connections to researchers and organisations that may be interested in exploring areas of common interest. *RC-4/DG.2, paragraph 40*



Scientific Literacy and Science Advice

(RC-4/DG.1, paragraphs 52 – 56)



Scientific Literature and Science Advice

- **SAB** advice is strengthened through **engagement with operational units of Secretariat.**
- **Continue to strengthen ability to monitor science and technology.** In maintaining this “watching brief”, the SAB and the Secretariat should be mindful of the importance of separating technological possibility from demonstrated technological capability.
- Engagement with expert communities: **scientific societies and innovation ecosystems.**



Scientific Literature and Science Advice



- ***Don't Stop the Science for Diplomats and Engagement with States Parties!***



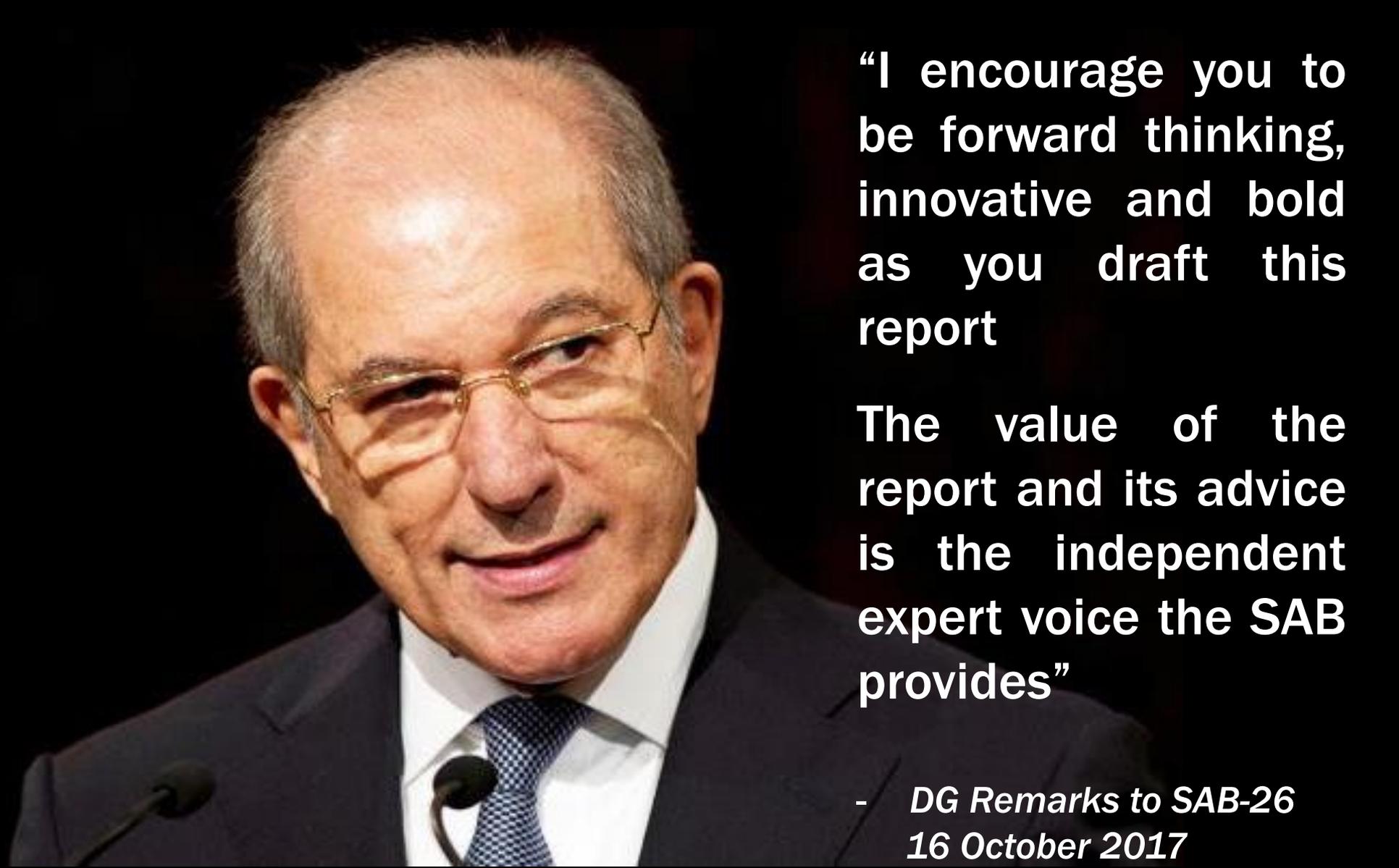
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From Director-General's Response (RC-4/DG.2)

Scientific Literacy and Science Advice

- Recognising that science-policy discourse also requires active efforts to be maintained and augmented, the Secretariat and the SAB will continue to organise briefings and “Science for Diplomats” events to engage States Parties. The Director-General appreciates the support of these initiatives by States Parties, and **encourages all States Parties to attend these events and to engage in the discussions.** *RC-4/DG.2, paragraph 44*
- The **Fourth Review Conference may wish to acknowledge the importance of supporting the scientific review process.** *RC-4/DG.2, paragraph 42*
- The **Fourth Review Conference may wish to express its support for the Secretariat's efforts** to effectively engage and draw upon expertise from scientific communities, to engage delegations on scientific topics and advice, and to ensure that the Secretariat is appropriately staffed for these activities *RC-4/DG.2, paragraph 45*





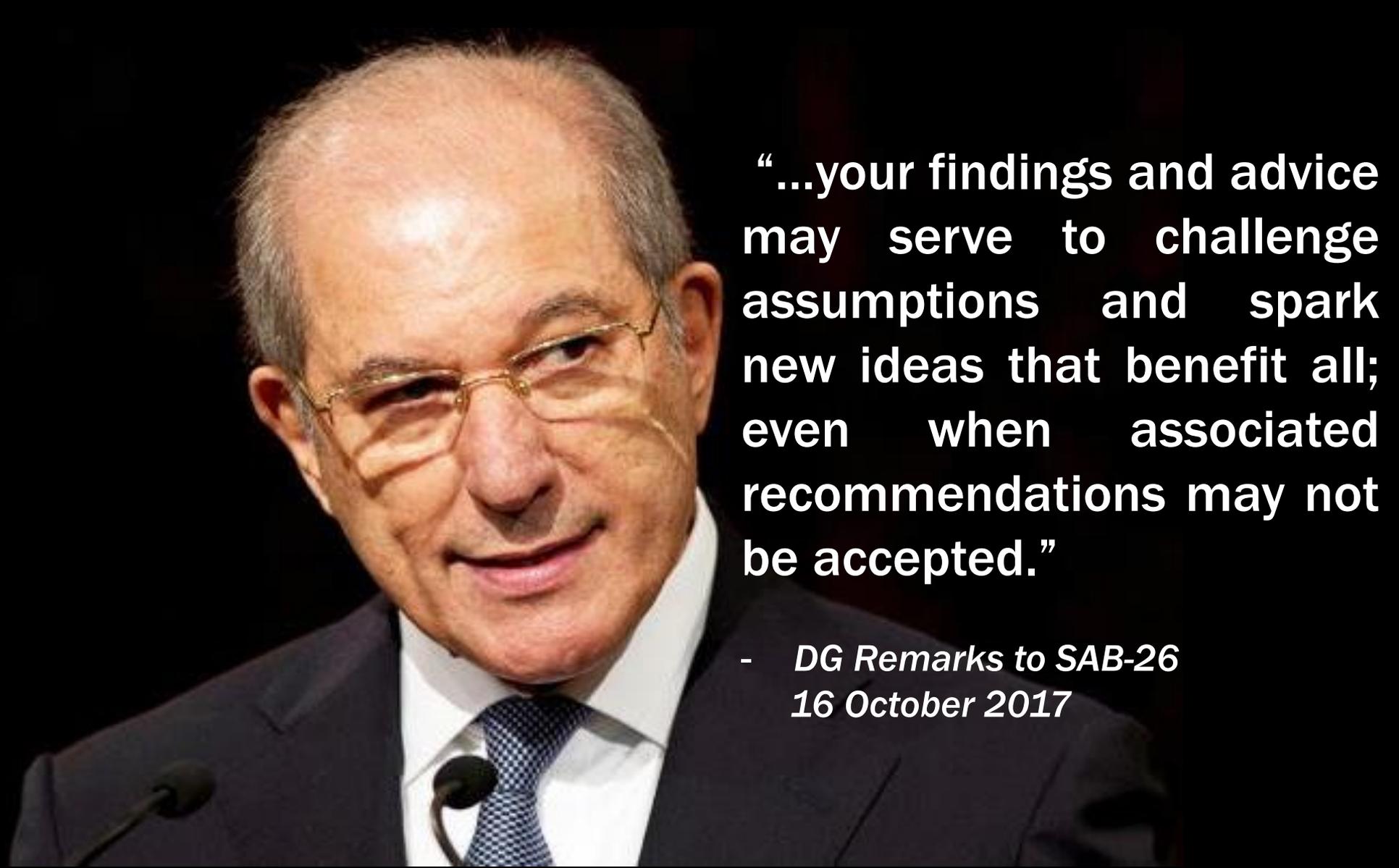
“I encourage you to be forward thinking, innovative and bold as you draft this report

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

**- *DG Remarks to SAB-26
16 October 2017***



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“...your findings and advice may serve to challenge assumptions and spark new ideas that benefit all; even when associated recommendations may not be accepted.”

**- *DG Remarks to SAB-26
16 October 2017***

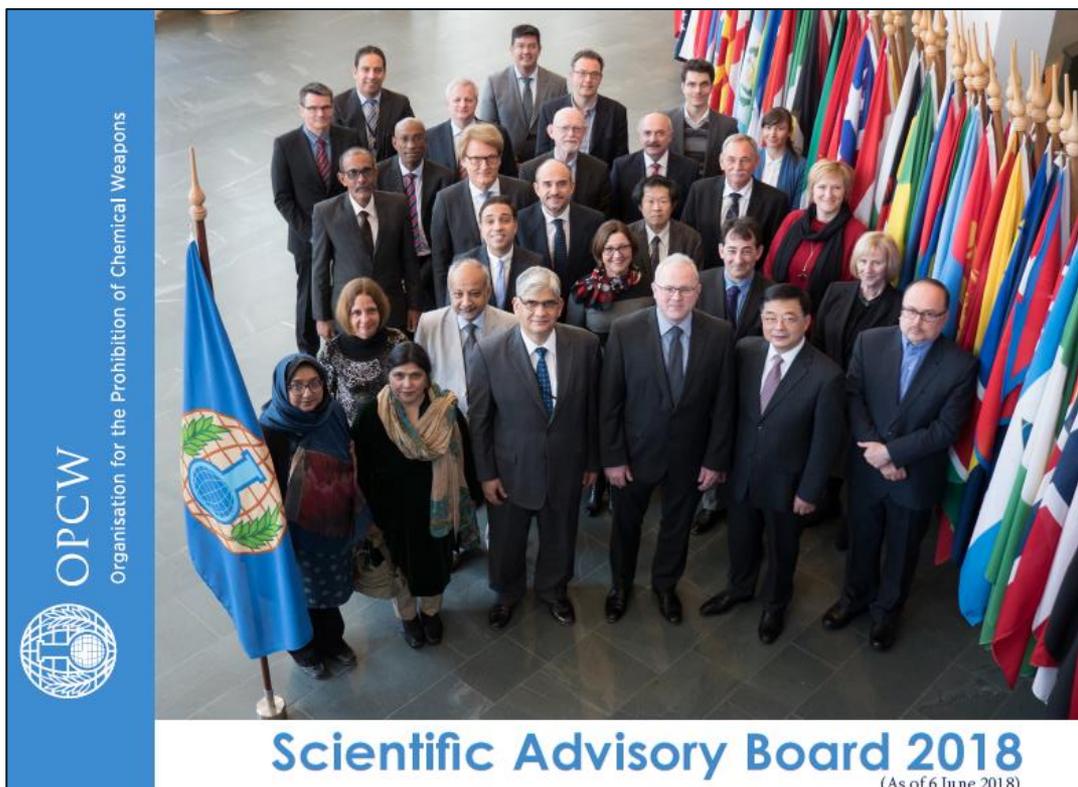


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From the Response of the Director-General (RC-4/DG.2)

- Ensuring that implementation of the Convention keeps pace with scientific advancements calls for scientific literacy, understanding how and why advancements are moving forward, and seizing opportunities to use scientific change as a means to enhance capabilities to mitigate challenges, both existing and yet to be seen.

Scientific Advisory Board from January to June 2018



Scientific Advisory Board 2018
(As of 6 June 2018)



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Organisation for the Prohibition of Chemical Weapons

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Summary of the First Meeting of the Scientific Advisory Board's Temporary Working Group on Investigative Science and Technology
(SAB-27/WP.1, dated 26 February 2018)

Report of the Scientific Advisory Board at its Twenty-Seventh Session
(SAB-27/1, dated 23 March 2018)

Director-General's Response to the Report of the Twenty-Seventh Session of the Scientific Advisory Board
(EC-88/DC.5, dated 9 May 2018)

Report of the Scientific Advisory Board on Developments in Science and Technology for the Fourth Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention
(RC-4/DC.1, dated 30 April 2018)

Response by the Director-General to the report of the Scientific Advisory Board on Developments in Science and Technology for the Fourth Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention
(RC-4/DC.2, dated 1 June 2018)



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منظمة حظر الأسلحة الكيميائية

禁止化学武器组织

Organisation for the Prohibition of Chemical Weapons

Organisation pour l'Interdiction des Armes Chimiques

Организация по запрещению химического оружия

Organización para la Prohibición de las Armas Químicas