



Twentieth Session  
10 – 14 June 2013

SAB-20/1

14 June 2013

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**REPORT OF THE TWENTIETH SESSION OF THE SCIENTIFIC ADVISORY BOARD****1. AGENDA ITEM ONE – Opening of the session and election of the Chairperson and Vice-Chairperson of the Scientific Advisory Board**

- 1.1 The Scientific Advisory Board (SAB) met for its Twentieth Session from 10 to 14 June 2013 at the OPCW Headquarters in The Hague, the Netherlands.
- 1.2 Prior to the opening of the session, Mr Stefan Mogl of Switzerland was unanimously re-elected as the Chairperson of the SAB, and Professor Alejandra Graciela Suárez of Argentina was unanimously re-elected as the Vice-Chairperson of the SAB.
- 1.3 The session was opened and chaired by Mr Stefan Mogl.

**2. AGENDA ITEM TWO – Adoption of the agenda**

The SAB adopted the following agenda for its Twentieth Session:

1. Opening of the session
2. Adoption of the agenda
3. *Tour de table* to introduce Scientific Advisory Board Members
4. Welcome address by the Director-General
5. Overview of developments at the OPCW since the last session of the Scientific Advisory Board
6. Establishment of a drafting committee
7. Developments in science and technology
  - (a) Temporary Working Group on the Convergence of Chemistry and Biology
  - (b) Convergence of the sciences: a perspective from the BWC Implementation Support Unit
  - (c) Monitoring developments in science and technology
  - (d) REACH regulations



8. Scientific and technological elements of verification technologies, emerging technologies and new equipment
9. Further scientific and technological advice relevant to the Convention
  - (a) Riot control agents
  - (b) Temporary Working Group on Education and Outreach in Science and Technology
  - (c) Outreach activities of the Secretariat
  - (d) Outreach activities by members of the SAB
  - (e) Medical countermeasures and treatments
10. Scheduled chemicals and advice on the Annex on Chemicals
  - (a) No discussion scheduled at this session
11. Relevant outcomes from the Third Special Session of the Conference of the States Parties to Review the Operation of the Convention
12. Visit to the OPCW Laboratory and Equipment Store in Rijswijk
13. Future work of the Scientific Advisory Board
  - (a) Roadmap of SAB work and activities of SAB members until the next SAB meeting
14. Any other business
  - (a) Date of the Twenty-First Session of the Scientific Advisory Board
15. Adoption of the report
16. Closure of the session

**3. AGENDA ITEM THREE – *Tour de table* to introduce Scientific Advisory Board members**

A *tour de table* was undertaken to introduce the SAB members. Four new members, Dr David González Berrutti (Uruguay), Dr Nicia Maria Fusaro Mourão (Brazil), Dr Christopher Timperley (United Kingdom of Great Britain and Northern Ireland) and Mr Francois Mauritz van Straten (South Africa), attended their first session of the SAB. Two SAB members, Shuzo Fujiwara of Japan and Nan Zhang of China, were unable to attend this meeting. A list of participants is contained in Annex 1.

**4. AGENDA ITEM FOUR – Welcome address by the Director-General**

- 4.1 The Director-General of the OPCW welcomed the SAB members to its Twentieth Session at OPCW Headquarters and thanked the departing members for their service;

Mr Mogl received special mention for his contributions as Chairperson for the past 18 months. New members were also welcomed.

- 4.2 The Director-General briefed the SAB on the outcome of the Third Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention (hereinafter “the Third Review Conference”), held in April 2013, where for the first time during a Review Conference, the SAB Chairperson presented the SAB analysis of the developments in science and technology. The Director-General informed the SAB that at its conclusion, the Third Review Conference acknowledged science and technology, the SAB, and its temporary working groups (TWGs) in the outcome document, including mentions in the political declaration.
- 4.3 The Director-General described the informal session on science and technology held during the Third Review Conference, where diplomats, non-governmental organisations, and scientists engaged in an informal discussion on science and security. The discussions encompassed education and outreach, the convergence of chemistry and biology, and the analytical methods and capabilities of the OPCW laboratory and highlighted the importance of these areas in the work of the OPCW. The Director-General noted that the education and outreach discussion received the greatest engagement from the participants and he informed the SAB of outreach activities the Technical Secretariat (hereinafter “the Secretariat”) will address in 2014.
- 4.4 The Director-General highlighted the agenda items of the Twentieth Session of the SAB, which included a tour of the OPCW Laboratory and Equipment Store. He noted the important work of the TWGs on the Convergence of Chemistry and Biology, on Education and Outreach, and on Verification, and requested that the TWGs prepare a comprehensive report at the end of their terms of reference that capture the depth and breadth of the discussion as well as recommendations. The first of these reports is expected at the end of 2013 from the TWG on the Convergence of Chemistry and Biology. The Director-General informed the SAB that he would be asking for advice on two additional questions: (1) riot control agents and (2) assistance and protection.
- 4.5 Thanking the Chairperson and other members of the SAB for their regular briefings to the policy-making organs, the Director-General stressed the importance of regular engagement between the SAB and the policy-making organs of the OPCW and States Parties. Enhancing their understanding and appreciation of the SAB’s work would further augment receptivity for its recommendations. Future opportunities for such interaction include the Fifteenth Annual Meeting of National Authorities and the Eighteenth Session of the Conference of the States Parties (hereinafter “the Conference”).

**5. AGENDA ITEM FIVE – Overview of developments at the OPCW since the last session of the Scientific Advisory Board**

- 5.1 The Secretary of the SAB, Stian Holen, reviewed developments at the OPCW since the SAB’s Nineteenth Session in September 2012. His presentation emphasised that science and technology underpin many Articles of the Chemical Weapons Convention (hereinafter “the Convention”) and thus are central to the OPCW’s future work, and he further elaborated on the Director-General’s remarks on the outcome of the Third

Review Conference, noting that the importance of science and technology and of the SAB at this conference was more prominent than at past review conferences.

- 5.2 The Secretary informed the SAB on the progress being made in the context of informal consultations amongst States Parties on issues related to the chemical industry (such as verification of mixed plant sites, transfer discrepancies, and refinements to inspections). He also updated the SAB members on the status of the destruction of chemical weapons and universality.
- 5.3 The Secretary described activities by the Secretariat and the SAB to engage with States Parties and other stakeholders to the Convention, including briefings by SAB members in the margins of sessions of the Executive Council (hereinafter “the Council”) and the Conference, side events on the margins of the Meeting of Experts and Meeting of States Parties of the Biological Weapons Convention (BWC), and upcoming side events at relevant scientific conferences.
- 5.4 The Secretary informed the SAB about the activities of the SAB Chairperson, who delivered a presentation on science and technology at the Wilton Park conference on 15 to 17 October 2012 on “CWC: Third Review Conference and Beyond”, addressed the States Parties in the open-ended working group (OEWG) for the Third Review Conference in October and November 2012, and gave a plenary presentation at the Third Review Conference.
- 5.5 Finally, he informed the SAB that the Secretariat had started developing policy options in relation to the recommendations in the Director-General’s response to the report to the Third Review Conference on developments in science and technology (RC-3/DG.2, dated 31 January 2013).
- 5.6 In the discussion, the following points were made:
  - (a) The SAB acknowledged that it is crucial for their recommendations to be clearly understood by policymakers. The continuing engagement with the States Parties had helped to bring issues of science and technology into policymaking. The SAB will strive to further improve its efforts to communicate clearly to non-technical audiences.
  - (b) The SAB thanked the Director-General, the Chairperson of the Open-Ended Working Group, and the Chairperson of the Review Conference for the opportunity to present its work during the preparatory phase and during the Third Review Conference. On-going engagement with the States Parties has been well received and informative to policymakers. Several SAB members shared positive comments they had heard from representatives of States Parties at the Review Conference.

## 6. **AGENDA ITEM SIX – Establishment of a drafting committee**

The SAB established a drafting committee, composed of five of its members, to prepare a draft report of its Twentieth Session.

## 7. AGENDA ITEM SEVEN – Developments in science and technology

### **Subitem 7(a): Convergence of chemistry and biology: intersessional work and report from the third meeting of the TWG on the Convergence of Chemistry and Biology**

- 7.1 The Chairperson of the TWG on the Convergence of Chemistry and Biology, William Kane, provided an overview of its third meeting, which was held on 3 and 4 April 2013, and its intersessional work. The report of the TWG is available through the OPCW website (SAB-20/WP.3, dated 11 April 2013) and reproduced in Annex 2.
- 7.2 A guest speaker at the TWG meeting, Dr Joel Cherry from Amyris Biotechnologies, provided an overview of how a bio-based process is developed in the lab and then scaled up to a large commercial production facility. The labwork required is extensive and a number of steps are automated to reduce the time required to develop a high-yield process. The company has developed an engineered yeast strain to convert sugar into farnesene, a C15 intermediate for the anti-malarial drug artemisinin.
- 7.3 Farnesene, which is also a chemical building block for a wide variety of other chemicals, has allowed the company to successfully market end products to a number of specialty markets (including biofuels, lubricants, polymer and plastic additives, cosmetics, flavours, and fragrances). Key information from the presentation includes the following: (1) significant capital investment and time was required to develop a cost-effective bio-process that could be scaled up for commercial production; (2) designing a high-yield bio-based process was an iterative process of DNA modification of a yeast strain followed by lab-scale testing to find the best candidates; and (3) scale-up required testing the new process in a pilot plant to validate operating conditions.
- 7.4 Apart from the production aspects of convergence, the TWG has also started to look at the positive developments related to the Convention. Three specific areas were reviewed in the last meeting: (1) advances in personal protective equipment; (2) advances in detection equipment; and (3) medical treatment for exposure to chemical agents. Despite the rapid advances and discoveries, commercial development has been slow for new equipment items. It remains a challenge to move from proof of concept under ideal lab conditions to rugged, field-ready products. The TWG will continue to monitor developments in these areas.
- 7.5 A number of areas for further study were also identified and assigned to members of the TWG for follow-up during the intersessional period. These items will be included in the agenda for the fourth meeting.
- 7.6 The SAB endorsed the report of the TWG and provided the following comments:
- (a) Biologically mediated production methods are becoming more common in industry, including production of chemicals using genetically modified organisms. It was noted that the move towards green and sustainable chemical processes promotes the use of biomediated methods.

- (b) It was suggested that plant tissue cultures might be used to produce toxic materials such as ricin and that this could hide typical signatures that are usually detectable by verification. This is an area of concern that the TWG will consider in the future.
- 7.7 The SAB was additionally informed that SPIEZ LABORATORY (Switzerland) is intending to organise workshops on convergence of the sciences, possibly starting in 2014. These events are intended to bring scientists and policymakers together to discuss benefits and concerns arising from developments in the sciences.

**Subitem 7(b): Convergence of the sciences: a perspective from the Biological and Toxins Weapons Convention Implementation Support Unit**

- 7.8 Piers Millet (guest speaker) from the Biological and Toxins Weapons Convention Implementation Support Unit (BWC ISU) presented an overview of the areas of convergence of the sciences that he felt are of most concern. He described how biology is intertwined with chemistry, but while the Biological and Toxin Weapons Convention (BWC) and the Convention share similar aims (e.g. to prevent the acquisition and use of weapons of mass destruction), how they are translated into action is quite different. At four pages, the BWC is largely aspirational; it lacks the detailed arrangements present in the Convention in that it has no verification regime and no international organisation. It is increasingly apparent, however, that the science on which the two treaties are based is similar. This opens opportunities for a closer relationship between the regimes. The most recent review conferences of both treaties noted this convergence and endorsed mechanisms to explore the overlap. The BWC ISU has identified five facets relevant to the work of the SAB: (1) reviewing advances in science and technology; (2) education and outreach; (3) the composition and involvement of relevant industries; (4) verification; and (5) implications derived from the lack of an implementing organisation.
- 7.9 The SAB thanked Dr Millet for his informative presentation. In the discussion, the following comments were made:
- (a) Concerns about the potential to use genetically engineered enzymes to create scheduled chemicals were raised. The TWG on the Convergence of Chemistry and Biology will be addressing these at its next meeting.
- (b) Technologies are available to model biological pathways within genetically modified organisms for a desired chemical output. Using genetic modification strategies to produce phosphorus, sulphur, or fluorine compounds may be possible and might evade verification.
- (c) The BWC relies on education and outreach activities to engage scientists to consider dual use and to recognise security issues in scientific research.
- (d) The SAB encouraged joint activities between the OPCW and the BWC ISU. Dr Millet noted that a side event at the Synthetic Biology Conference (SB6.0) in London was planned for July 2013 and the Secretariat and the BWC ISU were also planning a side event at the BWC Meeting of Experts in 2013.

**Subitem 7(c): Monitoring developments in science and technology**

- 7.10 Jonathan Forman (from the Secretariat) updated the SAB on the Secretariat's initiative to scan the horizon for relevant developments in science and technology and to monitor those of greatest relevance to the Convention. He presented the SAB with an overview of the approaches being considered and the issues that need to be addressed. A key message was the difference between monitoring known technologies and research (knowing what to search for) versus how to find new developments that may be relevant to the Convention. The SAB was asked for advice on defining search terms, selecting technology indicators for monitoring developments, software tools for the most efficient and effective information retrieval, and defining triggers to initiate follow-up actions.
- 7.11 In the discussion, the following points were made:
- (a) With the large volume of information available, it is important to focus on topics relevant to the Convention.
  - (b) The choice of technology indicators that are reported will dictate the efforts required: it might be most effective to follow trends and technology life-cycle metrics for developments of interest and to ask experts to evaluate threats and benefits.
- 7.12 Gillian Strong (guest speaker, Defence Science and Technology Laboratory, Dstl) presented the experience of the United Kingdom of Great Britain and Northern Ireland. She described how Dstl "horizon scanning" undertakes a systematic survey of the science and technology horizon to draw attention to emerging developments that are not otherwise addressed. Horizon scanning thus addresses gaps in the view of science and technology, and complements "technology watch". The presentation described horizon scanning and covered the difference between searching and scanning; the systematic approach used for scanning; some of the technical outputs produced, and exploitation of new and emerging science and technology within the research programme; and wider policy and strategy. Finally, the issue of how to handle science and technology risk was considered.
- 7.13 The SAB thanked Dr Strong for her informative presentation. In the discussion, the following points were made:
- (a) The effective use of horizon scanning requires collaboration among information specialists and subject-matter experts.
  - (b) The Secretariat is interested in using horizon scanning to recognise technologies of interest, and in using technology monitoring to follow developments.
- 7.14 Effectively supporting the OPCW in keeping abreast of scientific developments could involve a collaborative approach between the SAB and the Secretariat. This topic will be discussed at forthcoming SAB meetings.

**Subitem 7(d): REACH regulations**

- 7.15 Dr Ferruccio Trifirò described regulations and classifications under REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) and the European Chemicals Agency (ECHA) and how they are helping eliminate arsenic compounds from industrial use. He reviewed REACH regulations in relation to arsenic compounds, arsenic contamination in the environment, and options available to remove the use of arsenic compounds from industrial applications. There is significant contamination by arsenic compounds in groundwater globally, mainly as a result of industrial processes. He also described the uses of arsenic compounds for peaceful purposes. Further information can be found at:
- (a) [http://ec.europa.eu/environment/chemicals/reach/reach\\_intro.htm](http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm); and
  - (b) <http://echa.europa.eu/web/guest/regulations/reach/candidate-list-substances-in-articles>.

- 7.16 In the discussion, the SAB encouraged the Secretariat to engage with organisations such as ECHA that are responsible for implementing regulation regimes such as REACH in order to identify any shared interests.

**8. AGENDA ITEM EIGHT – Scientific and technological elements of verification technologies, emerging technologies and new equipment**

- 8.1 In accordance with paragraph 9 of the terms of reference of the SAB, a TWG on Verification has been established and held its first meeting on 19 and 20 March 2013. The report of the first meeting is available through the OPCW website (SAB-20/WP.2\*, dated 27 March 2013) and is reproduced in Annex 3. The TWG report also contains the terms of reference and the composition of the TWG.
- 8.2 Stian Holen (from the Secretariat) described the rationale for the formation of the TWG on Verification, and the Chairperson of the TWG, Roberto Martínez Álvarez, reported on its first meeting and intersessional work. Subgroups had been formed for each of the questions posed by the Director-General. The next meeting of the TWG on Verification will be held from 23 to 25 September 2013 in The Hague.
- 8.3 The SAB endorsed the report of the TWG and stated that the TWG should focus on contributions from science and technology.

**9. AGENDA ITEM NINE – Further scientific and technological advice relevant to the Convention**

**Subitem 9(a): Riot control agents**

- 9.1 Stian Holen (from the Secretariat) introduced a question from the Director-General about riot control agents (RCAs). The background and complete text of the question can be found in Annex 4. In summary, the Director-General requested the SAB to consider the initial list provided by the Secretariat of RCAs that have been declared by States Parties, have been researched, or are available for purchase, and requested the SAB to provide technical advice on the following:

- (a) whether the list reflects the current RCAs that could be considered as declarable in accordance with Article III(1)(e) of the Convention; and, in particular:
  - (b) the soundness of the criteria used by the Secretariat in drawing up the initial list;
  - (c) which other considerations or criteria, if any, should be used in developing the list;
  - (d) which chemicals, if any, should be deleted from the list; and
  - (e) which chemicals, if any, should be added to the list.
- 9.2 The SAB noted that this question is specific to RCAs and excludes incapacitating chemical agents and that it would be helpful to recall the background for the SAB's previous advice on RCAs in 2001 (see Annex 4).
- 9.3 The SAB agreed that it would continue addressing this question in correspondence in the forthcoming intersessional period. Christopher Timperley would lead this correspondence group and the SAB seeks to report to the Director-General by the end of January 2014.
- Subitem 9(b): Temporary Working Group on Education and Outreach in Science and Technology**
- 9.4 The Chairperson of the TWG on Education and Outreach, Djafer Benachour, reported from its second meeting, which was held from 22 to 24 November 2012, and its intersessional work. The report of the TWG is available through the OPCW website (SAB-20/WP.1, dated 25 February 2013) and reproduced in Annex 5.
- 9.5 A guest speaker at the TWG meeting, Dr Masamichi Minehata, of the University of Bradford, gave a presentation on action plans developed by his University to achieve the strategic objectives set out for the BWC meeting of States Parties.
- 9.6 The TWG meeting took place in conjunction with the Fourteenth Annual Meeting of National Authorities to help strengthen the interaction with States Parties. TWG members Bob Mathews, Alastair Hay, and Peter Mahaffy led an interactive session with the National Authority representatives, exploring how National Authorities may benefit from, and contribute to, enhanced education and outreach efforts. The conclusions and recommendations of the breakout group were presented by Alistair Hay and Peter Mahaffy to the National Authorities and highlighted the importance of education and outreach to the implementation of the Convention. They also gave examples of the audiences they are trying to reach. The clear message to the National Authorities is the need to match the content and focus of the presentation to the audience. The OPCW and National Authorities explored how they can jointly strengthen future education and outreach efforts.
- 9.7 The TWG emphasised the importance of interactions with organisations such as the International Union of Pure and Applied Chemistry (IUPAC) and suggested that interactions be extended to other international scientific institutions.

9.8 The SAB endorsed the report of the TWG and provided the following comments:

- (a) The SAB welcomes activities by the TWG aimed at reflecting the objectives of the Convention in regard to existing codes of ethics of chemistry organisations such as IUPAC and industry organisations such as the International Council of Chemical Associations (ICCA).
- (b) The use of online tools and e-learning provide opportunities to engage a broad audience.
- (c) Education and outreach should become a regular agenda item during the annual National Authority Days to share best practices.

**Subitem 9(c): Outreach activities of the Secretariat**

9.9 Daniel Feakes (from the Secretariat) gave an overview on the education and outreach activities of the Secretariat. He described the outcomes of the Third Review Conference and informed the SAB that the Secretariat was developing a strategy to guide its future education and outreach activities. Such activities will take place in cooperation with States Parties, relevant international organisations, and other stakeholders. Several projects are currently under way, including updating of internet-based educational materials, the development of educational materials for high school students, and an educational film produced by the Secretariat. A series of regional meetings on education and outreach during 2014, and for the commemoration of the centenary of the first use of chemical weapons in 2015, are planned.

9.10 Professor Ludo Juurlink (guest speaker from Leiden University) presented the educational module “Chemistry in Conflict” to the SAB. The SAB thanked Professor Juurlink for his informative presentation. The following comments were made in the discussion:

- (a) The Chemistry in Conflict modules have been introduced to high-school level students in the Netherlands. In other countries and/or educational levels, the materials introduced into a classroom may need to be approved by the relevant authorities.
- (b) Dual-use and ethics considerations should be discussed with the students.

**Subitem 9(d): Outreach activities by members of the SAB**

9.11 Some of the SAB members described outreach activities they are involved in.

**Subitem 9(e): Medical countermeasures and treatments**

9.12 Cristina Rodrigues (from the Secretariat) presented an overview of Article X of the Convention, together with the summary of relevant activities in the last five years. The implementation of Article X is based on cooperation between the Secretariat and States Parties with the aim of creating and increasing national protective capacity against chemical weapons and preparing the OPCW to deal with a possible request of assistance in case of use, or threat of use, of chemical warfare agents in States Parties.

- 9.13 Ms Rodrigues informed the SAB that the Sixteenth Session of the Conference in 2011 endorsed a proposal for the establishment of an international support network for the victims of chemical weapons. The establishment of this network, together with requests from several States Parties, created the need for the development of new medical training courses, which requires information on new developments of medical countermeasures and treatments.
- 9.14 The Director-General requested (see Annex 6) the SAB to:
- (a) recommend to the Secretariat pre-treatments, vaccines, emergency care, and long-term treatments that are currently available for blister and nerve agents; and
  - (b) inform the Secretariat of the most relevant information sources that can be monitored to keep abreast of new developments in these areas.

- 9.15 The SAB will aim to collect current best practices and agreed that it would continue addressing this question during the forthcoming intersessional period. The SAB noted the experience of the Islamic Republic of Iran in treating victims of chemical warfare agents, and Mohammad Abdollahi volunteered to participate in the correspondence group to share his expertise. Slavica Vučinić will lead this correspondence group, and the SAB seeks to report to the Director-General by the end of January 2014.

**10. AGENDA ITEM TEN – Scheduled chemicals and advice on the Annex on Chemicals**

No discussion was scheduled for this topic at this session of the SAB.

**11. AGENDA ITEM ELEVEN – Relevant outcomes from the Third Special Session of the Conference of States Parties to Review the Operation of the Convention**

- 11.1 Alexander Kelle (from the Secretariat) gave an overview of the various organisational and substantive aspects of the Third Review Conference. He concluded with a short summary of follow-up measures planned by the Secretariat and the Council.
- 11.2 Jonathan Forman presented the SAB with additional details on the outcome of the Third Review Conference with regard to science and technology. More than half of the over 70 States Parties participating in the general debate noted science and technology, with a number of statements acknowledging the work of the SAB and its TWGs, and convergence of the sciences.
- 11.3 The Director-General's response to the report of the SAB on developments in science and technology (RC-3/DG.2) contained 29 recommendations. The SAB was briefed on these and on how the Secretariat was intending to address them. The recommendations could be summarised as follows: science and technology monitoring; laboratory activities; knowledge and expertise (e.g., for maintaining relevant knowledge, expertise, and experience levels); education and outreach, including engagement with industry; and verification.
- 11.4 The SAB has a better understanding on how the Secretariat intends to take forward its recommendations. The SAB was informed that the Director-General will develop

policy options and, where necessary, involve the policy-making organs. The SAB stands ready to assist with technical advice at any step in the process.

**12. AGENDA ITEM TWELVE – Visit to the OPCW Laboratory and Equipment Store in Rijswijk**

The SAB visited the OPCW Laboratory and Equipment Store in Rijswijk, where it was briefed on the logistical aspects of the Inspectorate and the capabilities of the Laboratory and the OPCW Designated Laboratory System. The SAB was grateful to Murty Mamidanna, Franz Krawinkler, and Michael Barret for their presentations.

**13. AGENDA ITEM THIRTEEN – Future work of the Scientific Advisory Board**

**Subitem 13(a): Roadmap of SAB work and activities of SAB members until the next SAB meeting**

- 13.1 The Secretary to the SAB introduced the intersessional activities of the SAB and the Secretariat, and the SAB endorsed tentative dates for the TWG meetings:
  - (a) The second meeting of the TWG on Verification is tentatively scheduled for 23 to 25 September 2013.
  - (b) The fourth meeting of the TWG on the Convergence of Chemistry and Biology is tentatively scheduled for 5 to 7 November 2013.
  - (c) The third meeting of the TWG on Education and Outreach is tentatively scheduled in parallel with the Annual Meeting of the National Authorities to be held from 27 to 30 November 2013.
- 13.2 SAB members were invited to submit articles for publication in *OPCW Today*. Education and outreach would likely be the theme of the second issue of 2013.

**14. AGENDA ITEM FOURTEEN – Any other business**

- 14.1 On the margins of the SAB meeting, the SAB Chairperson and all TWG chairpersons had an informal discussion with Secretariat staff members. The SAB welcomed such interactions and would like to continue this practice in the future.
- 14.2 The SAB Chairperson presented an overview of the activities of the Twentieth Session of the SAB to representatives of States Parties and engaged with them in discussion. Feedback was positive and the SAB would like to continue these interactions in the future.
- 14.3 The SAB agreed that each TWG would produce a final report. A format for such reports was agreed to include an executive summary, followed by findings, outlook, and recommendations. The format and layout of the report is designed to appeal to a wider audience.
- 14.4 Reports from TWG meetings will be issued as SAB working papers (when TWG meetings are held more than one week prior to a SAB meeting), made available on the OPCW website, and considered at the next forthcoming SAB session.

- 14.5 The SAB proposed updating the SAB portals to facilitate interaction between members during intersessional periods.
- 14.6 The SAB Chairperson bade farewell to Dr Shuzo Fujiwara and Dr Igor Rybalchenko whose second terms of office on the SAB end in October 2013. He thanked both members for their contributions to the work of the SAB. The Vice-Chairperson of the SAB bade farewell to Mr Stefan Mogl, who will also be ending his second term in October.
- 14.7 Since Mr Stefan Mogl will leave the Board prior to its next session, Professor Alejandra Graciela Suárez was elected Chairperson and Dr Christopher Timperley was elected Vice-Chairperson, both with effect from 15 June 2013.

**Subitem 14(a): Date of the Twenty-First Session of the Scientific Advisory Board**

- 14.8 The Twenty-First Session of the SAB was tentatively scheduled for June 2014.
- 14.9 The SAB members stated that they preferred to have two SAB meetings per year and asked the Secretariat to consider this for 2014.

**15. AGENDA ITEM FIFTEEN – Adoption of the report**

The SAB considered and adopted the report of its Twentieth Session.

**16. AGENDA ITEM SIXTEEN – Closure of the session**

The Chairperson closed the session at 17:15 on 14 June 2013.

Annexes:

- Annex 1: List of Participants in the Twentieth Session of the Scientific Advisory Board
- Annex 2: (English only, unedited): Report of the Third Meeting of the Scientific Advisory Board Temporary Working Group on the Convergence of Chemistry and Biology; The Hague, the Netherlands, 3 – 4 April 2013
- Annex 3: (English only, unedited): Report of the First Meeting of the Scientific Advisory Board Temporary Working Group on Verification; The Hague, the Netherlands, 19 – 20 March 2013
- Annex 4: (English only): Director-General’s Request to the Scientific Advisory Board to Consider Which Riot Control Agents are Subject to Declaration under the Chemical Weapons Convention
- Annex 5: (English only, unedited): Report of the Second Meeting of the SAB Temporary Working Group on Education and Outreach in Science and Technology Relevant to the Chemical Weapons Convention; The Hague, the Netherlands, 22 – 24 November 2012
- Annex 6: (English only): Director-General’s Request to the Scientific Advisory Board to Provide Further Advice on Assistance and Protection

**Annex 1****LIST OF PARTICIPANTS IN THE TWENTIETH SESSION  
OF THE SCIENTIFIC ADVISORY BOARD<sup>1</sup>**

	<b>Participant</b>	<b>Institution</b>
1.	Abdollahi, Mohammad	Tehran University of Medical Sciences, the Islamic Republic of Iran
2.	Al-Amri, Abdullah	Saudi Basic Industries Corporation, Riyadh, Saudi Arabia
3.	Baulig, Augustin	Secrétariat général de la défense et de la sécurité nationale, Paris, France
4.	Benachour, Djafer	LMPMP, Faculty of Technology, Ferhat Abbas University, Setif-1, Algeria
5.	González Berutti, David	Department of Chemistry, University of the Republic of Uruguay, Montevideo, Uruguay
6.	Cariño, Flerida Arsciwals	Institute of Chemistry, University of the Philippines
7.	Dubey, Devendra Kumar	Vertox Laboratory, Gwalior, India
8.	Mourão, Nicia Maria Fusaro	ABIQUIM (Brazilian Chemical Industry Association), São Paulo, Brazil
9.	Geist, Michael	BASF SE, Ludwigshafen, Germany
10.	Kane, William	Consultant to Monsanto Company, Louisiana, United States of America
11.	Martínez Álvarez, Roberto	Complutense University, Madrid, Spain
12.	Mogl, Stefan <sup>2</sup>	SPIEZ Laboratory, Spiez, Switzerland
13.	Muhammad Zafar-Uz-Zaman	National Engineering and Scientific Commission (NESCOM), Islamabad, Pakistan
14.	Neffe, Slawomir	Military University of Technology, Warsaw, Poland
15.	Rybalchenko, Igor V.	Military Science Centre of the Ministry of Defence, Moscow, the Russian Federation
16.	Suárez, Alejandra Graciela <sup>3</sup>	Universidad Nacional de Rosario. Consejo Nacional de Investigaciones Científicas y Técnicas. Argentina
17.	Timperley, Christopher <sup>4</sup>	Defence Science and Technology Laboratory (Dstl), Porton Down, United Kingdom of Great Britain and Northern Ireland
18.	Trifirò, Ferruccio	Department of Industrial Chemistry, University of Bologna, Italy
19.	van Straten, Francois Mauritz	South African Nuclear Energy Corporation SOC Ltd, Pretoria, South Africa
20.	Vanninen, Paula	VERIFIN, Department of Chemistry, Faculty of Science, University of Helsinki, Finland
21.	Vučinić, Slavica	National Poison Control Centre, Military Medical Academy, Belgrade, Serbia
22.	Zaitsev, Volodymyr	Taras Shevchenko National University of Kyiv, Ukraine
23.	Zina, Mongia Said	Faculty of Sciences of Tunis, Tunisia

<sup>1</sup> Shuzo Fujiwara and Nan Zhang did not attend the Twentieth Session of the SAB.<sup>2</sup> Chairperson of the SAB until 14 June 2013<sup>3</sup> Vice-Chairperson of the SAB until 14 June 2013 and Chairperson of the SAB from 15 June 2013<sup>4</sup> Vice-Chairperson of the SAB from 15 June 2013

## Annex 2

### **REPORT OF THE THIRD MEETING OF THE TEMPORARY WORKING GROUP ON THE CONVERGENCE OF CHEMISTRY AND BIOLOGY THE HAGUE, THE NETHERLANDS 3 - 4 APRIL 2013**

#### **1. AGENDA ITEM ONE – Opening of the meeting and adoption of the agenda**

- 1.1 The Scientific Advisory Board (SAB) Temporary Working Group (TWG) on the Convergence of Chemistry and Biology held its third meeting on 3 to 4 April 2013 at OPCW Headquarters in The Hague.
- 1.2 The meeting was chaired by William Kane on behalf of the SAB.
- 1.3 The meeting began with a tour de table to introduce the members of the TWG and invited guest speakers. The list of participants is given in Appendix 1.
- 1.4 The following agenda was adopted:
  - (i) Opening of the meeting and adoption of the agenda;
  - (ii) Biologically mediated synthesis of chemicals.
  - (iii) Whether any biotechnological processes exist, other than biologically mediated synthesis, that are of relevance to the implementation of the CWC.
  - (iv) The meaning of “produced by synthesis”.
  - (v) Whether there are other scientific disciplines, apart from biology, that are converging in a significant way with chemistry.
  - (vi) The potential benefits to the CWC of the convergence of chemistry and biology.
  - (vii) Any other business, and
  - (viii) Recommendations, intersessional work, adoption of the TWG report from the meeting, and date of the next meeting.

#### **2. AGENDA ITEM TWO – Biologically mediated synthesis of chemicals**

- 2.1 Robert Mathews provided his perspective on the CWC negotiating history of the term “biologically mediated processes”. The speaker recalled that in 1992, there was lack of agreement as to whether the OCPF regime should be limited to ‘purely chemical production processes’ (i.e. where all reactants, catalysts, etc. were chemicals) or whether chemical production processes containing a ‘biological element’ (e.g. bio-mass feedstock, biological catalyst, fermentation process, etc.) should also be included. This issue could not be resolved by the Geneva negotiators so in order to

obtain an agreed Convention text which could be endorsed by the UN General Assembly, a ‘creative ambiguity’ was inserted in the Convention Text in Part IX Paragraph 1 with the term “produced by synthesis”. This term was interpreted as chemical production without any biological element by those wanting to exclude “biological production” of chemicals, and to include production processes containing a ‘biological element’ (e.g. biosynthesis) by those who wanted biological production included in the OCPF regime. The presentation concluded with the question: What is the term most commonly used by industry in 2013 when referring to chemical production processes which contain a ‘biological element’?

- 2.2 The speaker recalled that in the OPCW Preparatory Commission, the term “biologically mediated process” was developed in an unsuccessful attempt to resolve the “production by synthesis”. He noted that the term “biologically mediated process” is not used in the Convention and was never defined by the Preparatory Commission.
- 2.3 Action: In discussion, the TWG suggested a different term that could capture all relevant biological processes used in production of chemicals would be useful. All TWG members were requested to give this some thought in advance of the next meeting.
- 2.4 In following up recommendations from the first two TWG meetings, Professor Scott Mohr (Boston University, guest speaker) presented an overview of bioregulators and toxins as potential bioweapons, pointing out their utility for limited-scale attacks, but unlikely use in major operations. He then gave a summary of the potential of synthetic biology and de novo enzyme engineering (as exemplified, for example, by the work of Professor David Baker’s group at the University of Washington) to create novel, powerful and difficult-to-detect bioweapons, including a modified version of anthrax that could be extremely potent. He also observed that sophisticated new DNA sequence-analysis tools (in particular Professor Evan Johnson’s new tool “Pathoscope”) should prove valuable in identifying disguised, pathogenic organisms.
- 2.5 In discussion, the following points were made:
  - (a) Action: The TWG proposed to invite a speaker with expertise in drug delivery technology, especially in regards to aerosolisation, formulation, avoiding host defences, and targeting, to further explore the risk of weaponisation of bioregulators.
  - (b) Large scale production of toxins could be easier with engineered organisms.
  - (c) Use of synthetic biology to engineer safety into a microbial “chassis” was noted. However, such developments were moving forward slowly.
- 2.6 Hua Li presented information on the application of biologically mediated production to the synthesis/production of ricin (a Schedule 1A chemical). Key points were:
  - (a) Awareness and concerns about ricin have been growing in the past decade as the result of increased incidents of attempted ricin poisoning and terrorism-related activities.

- (b) Recent research is mainly focused on ricin toxicity, detection, countermeasures and its medical applications (e.g. immunotoxins used for cancer therapy).
  - (c) Castor beans are still the main source of crude and pure ricin, and the extraction and purification processes are relatively easy and cheap.
  - (d) Ricin, A-chain, B-chain and their analogues can be produced by biologically mediated synthesis.
  - (e) Recently, a draft genome sequence of the ricin producing oilseed castor bean was published. This may enable metabolic engineering to obtain safe sources for improving castor oil production in crop plants lacking ricin. It may also have implications on biologically mediated process for ricin production.
- 2.7 Action: The TWG concurred with the presentation. Evidently, ricin research is a representative model for production of protein toxins using biologically mediated methods and provides further insight into advances in countermeasures and detection. Hua Li agreed to follow relevant developments and report to the TWG at the next meeting.
- 2.8 Piers Millet summarized an article on a synthetic ribosome to highlight the rapid progress where simple designed molecules perform tasks similar to those of biological components.<sup>5</sup> The authors claim a molecular machine could replace the need for engineered organisms for the synthesis of peptides and other biological materials.
- 2.9 In discussion, the following points were made:
- (a) These reports provide strong examples of why it is important to further explore the convergence of chemistry and biology.
  - (b) Use of the topological capacity of DNA to engineer novel molecular shapes has potential convergence with nanotechnology.
- 2.10 Dr. Joel Cherry (President of R&D, Amyris Biotechnologies; guest speaker) presented an overview of Amyris Biotechnologies. The company had started out with a research project to synthesize the anti malaria drug artemisinin through metabolic pathway engineering of yeast cells. Based on the results of that research, the company has developed an industrial biology platform that synthesises a range of organic chemicals that are found in a variety of consumer products including fuels, lubricants, home and personal care products, polymers and plastic additives, flavors and fragrances, and cosmetics. The company produces for example squalane, an important ingredient for cosmetics that generally has been extracted from deep water shark liver oil. The company produced engineered yeast cells utilizing, among other techniques, random mutagenesis. As a result of this, using sugar as a feedstock, branched unsaturated hydrocarbons can be produced on an industrial scale in very large fermenters with volumes in excess of hundred thousand litres.

<sup>5</sup>

B. Lewandowski et al, *Science*, 11 January 2013, Vol. 339 no. 6116 pp. 189-193; see also J. Wang, B. Feringa, *Science*, 18 March 2011, Vol. 331 no. 6023 pp. 1429-1432.

2.11 The TWG noted the following points from the presentation:

- (a) The presentation provided insight into what was required to work with an engineered yeast-strain production process from laboratory research to pilot plant and scale-up to commercial operation.
- (b) Significant investment and time are required to build the technical platform to go from microliter plate screening of yeast-strain candidates to commercially meaningful production of materials.
- (c) The application of microfluidics and increased use of automation have begun to improve the turn around time for the identification of scale-up candidates.
- (d) Yeast was noted as the preferred chassis over E. coli for the Amyris product line; benefits are post-translational modification, homologous recombination, and less toxic waste disposal.
- (e) All fermenter-based production sites have potential, with appropriate DNA input into the chassis organism, to produce toxins. Screening at the point of DNA synthesis could be the best way to monitor.
- (f) The presentation demonstrated how mature the methods and techniques have become and that large numbers of complex chemicals can be produced on a commercial scale by engineered organisms.
- (g) The TWG noted that Amyris was originally founded by three post-doctoral fellows in 2003. Ten years later the company is developing and producing chemicals for a broad range of consumer products using a synthetic biology platform on an industrial scale.

2.12 Action: Having considered and discussed the five presentations, the TWG thought it would be useful to invite guest speakers on the design of enzymes, and the use of engineered plants to produce vaccines (which could be useful in the context of the TWG's deliberation on countermeasures).

2.13 Action: Furthermore, Scott Mohr agreed to prepare a brief background note on the design of enzymes and Bill Provine offered to update the group on the enzymes produced by DuPont. Piers Millet agreed to provide a briefing on the use of engineered DNA scaffolds to improve catalytic efficiency.

2.14 The TWG noted that biotechnology industry-led security concerns are being addressed through a raft of complementary measures including screening of conventional gene synthesis orders and community engagement.

**3. AGENDA ITEM THREE – Whether any biotechnological processes exist, other than biologically mediated synthesis, that are of relevance to the implementation of the CWC**

- 3.1 William Kane recalled from the previous meeting that the purpose of this agenda item is to make sure the TWG considers all chemical production processes using biological methods.
- 3.2 In discussion the following points were made:
- (a) From the discussion under Agenda Item 2, the TWG now understood this term of reference to mean “what are the applications of life sciences relative to the CWC?” and would further explore the topic along this line.
  - (b) Action: Each TWG member agreed to forward to the TWG chair and secretary any relevant novel examples of convergence reported in the scientific literature, for review by the TWG. The TWG secretary would post these articles on the TWG portal.

**4. AGENDA ITEM FOUR – The meaning of “produced by synthesis”**

- 4.1 Stefan Mogl recalled in a presentation that the TWG in its last meeting had recommended that any process designed for the formation of a chemical substance should be covered by the term “produced by synthesis” (VA.IX.1a), and that the SAB had endorsed this recommendation (SAB-19/1 and RC-3/DG.1). He emphasized that if this recommendation was to be implemented, a discussion should be held on what technical guidance the TWG could provide to assist the identification of relevant facilities that are employing biological and biologically mediated processes, and which may be considered relevant to the CWC in the future.
- 4.2 The discussion that followed emphasized that there has been a significant increase in the production of chemicals through biological and biologically mediated processes. The TWG agreed that there were a number of factors to be considered, some applying to this TWG and others more to the TWG on Verification, which should also be consulted on the matter. The group agreed that for the next meeting, all members should prepare themselves for a technical discussion on the potential implications that this development may have for implementation of Part IX of the Verification Appendix.
- 4.3 In discussion, the following points were made:
- (a) Action: Robin Black and Stefan Mogl agreed to brief the convergence TWG on the relevant outcomes from the verification TWG meeting scheduled for September 2013.
  - (b) Action: Commentators claim that by the year 2020, 10% of the volume of all chemical products will be produced by biological or biologically mediated processes. The TWG acknowledged that technical aspects of these changes will need to be addressed in a timely fashion.

**5. AGENDA ITEM FIVE – Whether there are other scientific disciplines, apart from biology, that are converging in a significant way with chemistry**

- 5.1 The TWG recalled that numerous scientific disciplines, e.g. engineering, mathematics, physics, materials science, computer science, and informatics were enabling the convergence of chemistry and biology. In discussion, the following points were made:
- (a) The TWG understood this term of reference to cover developments in other scientific disciplines and technologies that are relevant to CWC.
  - (b) Action: The TWG considered that bioregulators presently pose a low risk for use as a chemical weapon. However, since nanopackaging/delivery could change this view; Djafer Benachour agreed to look into this aspect during the intersessional period.
  - (c) Action: Piers Millet agreed to draw on the work done in the BWC context on monitoring enabling technologies and to brief the TWG further.
  - (d) Action: Robin Black agreed to look into biosensors during the intersessional period.
  - (e) Action: Scott Mohr agreed to look into the extent to which informatics is converging with chemistry.

**6. AGENDA ITEM SIX – The potential benefits to the CWC of the convergence of chemistry and biology**

- 6.1 Mahdi Balali-Mood presented a comprehensive overview of medical treatments against nerve agents and presented clinical data on victims of sulfur mustard exposure in the Iran-Iraq war. The speaker noted that benefits in treatments for sulfur mustard are mostly supportive and symptomatic.
- 6.2 Robin Black presented an overview of advances in detection, focused on Schedule 1 chemicals, mostly on nerve agents. Although the majority of fielded chemical warfare agent (CWA) detectors rely on physicochemical principles, CWA detectors with biological sensing elements have been in service for more than 40 years. The most widespread examples are the use of the enzymes acetylcholinesterase and butyrylcholinesterase for the detection of organophosphorus nerve agents. These enzymes have been used in automated vapour detectors, wet chemistry kits, tickets and Dräger-type tubes, and provide very sensitive devices for detecting nerve agents. More recently a contamination disclosure spray based on cholinesterase has been commercialised. Most of the recent developments employing biological sensing elements have concerned prototype biosensor diagnostic devices for nerve agent exposure. These have been based mainly on measuring active cholinesterase in blood, some including a reactivation stage to overcome the problem of uncertain baseline levels of enzyme. Biosensors based on the enzyme OP hydrolase have also been reported, as have a limited number of immunoassays. Future developments are likely to include improved enzymes and antibodies, and further exploitation of

nanotechnology. Bioassays have generally been the norm for initial detection of saxitoxin and ricin, and have benefitted from recent technological advances.

6.3 In discussion, the following points were made:

- (a) The TWG noted that it is unlikely that detectors with biological sensing can meet all requirements for field CW agent detectors for the foreseeable future.
- (b) Higher affinity antibodies and engineered enzymes would be needed for improvements.
- (c) Action: Phillip Coleman agreed to inform the group about advances in portable mass spectrometers at the next TWG meeting.

6.4 Robert Mathews presented an overview of developments in physical protective equipment and the effect of convergence and nanotechnology on current and future approaches. He noted that current research is directed at enhanced protection and more user friendly materials that provide reduced physiological burden and are less cumbersome. He also noted research efforts to develop self decontaminating protective clothing (incorporation of enzyme and/or catalysts).

6.5 In discussion, the following points were made:

- (a) The TWG noted that it is difficult to improve on carbon as a filter material, due to its adsorbent properties and relatively low cost. Layers of carbon cloth and fibres are very promising as a way to keep adsorption properties and make more user friendly filters.
- (b) The TWG noted that aerosol protection is currently lacking in much of the available protective gear.
- (c) Noting that companies producing protective equipment are currently supplying first responders (fire, police, hazardous material clean up crews, etc), the TWG suggested to broaden the scope of its monitoring of protective equipment to include first responders.
- (d) Action: The 11th International Symposium On Protection Against Chemical And Biological Warfare Agents will be held in Stockholm in June 2013. Hua Li agreed to report back to the TWG on developments showcased at this exhibition.

6.6 Piers Millet presented some new developments in prion research.<sup>6</sup> In discussion, the TWG recommended to monitor such developments as the understanding of the way chemical changes in structure can impact biological function, could lead to improved countermeasures.

6.7 In discussion of the four presentations, the TWG noted that despite the rapid pace of advances and discoveries, commercial development has been slow. It was pointed out

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<sup>6</sup> J. Bremer et al, *Nature Neuroscience*, 2010, Vol. 13. 310-318 .

that it is difficult to move from proof of concept under ideal laboratory conditions to rugged fieldable products.

**7. AGENDA ITEM SEVEN – Any other business**

- 7.1 Piers Millett reviewed a series of papers examining the use of Clustered Regularly Interspaced Palindromic Repeats (CRISPR) and CRISPR Associated System 9 (CAS9) for genome engineering as an example of an emerging enabling technology in the life sciences.<sup>7</sup> The CRISPR CAS9 system was identified in 2012 as the mechanism used by bacteria to incorporate into their genome, elements taken from viruses they have encountered. This was the mechanism enabling a previously identified rudimentary ‘immune’ system against viral infections and horizontal gene transfer. Papers published in February and March 2013 suggest that the CRISPR CAS9 system can be altered to enable cheap, flexible and fully customisable editing of DNA in humans, mice and yeast. Proponents of the system suggest that it might become a major enabling tool over the coming years.

**8. AGENDA ITEM EIGHT – Conclusions, recommendations, plan of action for intersessional period, elaboration of the TWG report and date of the next meeting**

- 8.1 Recommendations and action points for the intersessional period are recorded under the relevant agenda items: cf paragraphs 2.3, 2.5, 2.7, 2.12, 2.13, 3.2, 4.3, 5.1, 6.3, and 6.5.
- 8.2 The fourth meeting of the TWG was tentatively scheduled for 5-7 November, 2013.
- 8.3 Bearing in mind paragraph 5 of the terms of reference of the TWG, the TWG will produce a summary report of its findings and recommendations by the end of the two years, and forward this to the SAB and the Director-General for their review.

**9. AGENDA ITEM NINE – Closure of the meeting**

- 9.1 The Chairperson closed the meeting at 19:10 on 4 April 2013.

Appendix: List of members of, and participants in, the Third Meeting of the Temporary Working Group on the Convergence of Chemistry and Biology.

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R. Barrangou, *Science*, 23 March 2007, Vol. 315, pp. 1709-1712; E. Deltcheva, *Nature*, 31 March 2011, Vol 471 pp 602-607; A. Al-Attar, et al, *Biological Chemistry*. Vol. 392, Issue 4, Pages 277–289; P. Mali, et al, *Science*, 15 February 2013, Vol. 337, pp. 823-826; M. Jinek, et al, *Science*, 17 August 2012, Vol. 337, pp. 816-821; L. Cong, et al, *Science*, 15 February 2013, Vol. 337, pp. 819-823.

## Appendix

**LIST OF PARTICIPANTS IN THE THIRD MEETING OF THE TEMPORARY  
WORKING GROUP ON THE CONVERGENCE OF CHEMISTRY AND BIOLOGY  
THE HAGUE, THE NETHERLANDS  
3 - 4 APRIL 2013**

<b>Participant</b>	<b>Institution</b>
Professor Mahdi Balali-Mood	Medical Toxicology Centre, Imam Reza Hospital, University of Medical Sciences, Mashhad, Islamic Republic of Iran
Professor Djafer Benachour*	Ferhat Abbas University, Ministry of Higher Education and Scientific Research, Setif, Algeria
Dr. Robin Black	Defence Science and Technology Laboratory (DSTL), Porton Down, United Kingdom of Great Britain and Northern Ireland
Dr. Philip Coleman	ECM Technology (Pty) Ltd, Pretoria, South Africa
Professor Roderick Flower	William Harvey Research Institute at Barts and the London School of Medicine and Dentistry, United Kingdom of Great Britain and Northern Ireland
Mr. William Kane <sup>8</sup> *	Consultant of Monsanto Company, United States of America
Professor Hua Li	Chinese Academy of Military Medical Sciences., China
Dr. Robert Mathews	Defence Science and Technology Organisation, Melbourne, Australia
Dr. Piers D. Millet	United Nations, Switzerland
Mr. Stefan Mogl*	Spiez Laboratory, Switzerland
Dr. William D. Provine <sup>9</sup>	DuPont Central Research & Development, United States of America
Professor Igor Rybalchenko*	Military Science Centre of the Ministry of Defence, Moscow, Russian federation
Dr. Muhammad Zafar-Uz-Zaman*	National Engineering and Scientific Commission (NESCOM), Islamabad, Pakistan
Dr. Joel Cherry (guest speaker)	Amyris Biotechnologies, Emeryville, United States of America
Professor Scott Mohr (guest speaker)	Bioinformatics Graduate Program and the Department of Chemistry, Boston University, United States of America

\*Member of the Scientific Advisory Board.

<sup>8</sup>

Chairman of the TWG on the Convergence of Chemistry and Biology.

<sup>9</sup>

Attended by teleconference on the first day and the second half of the second day.

### **Annex 3**

## **REPORT FROM THE FIRST MEETING OF THE TEMPORARY WORKING GROUP ON VERIFICATION THE HAGUE, THE NETHERLANDS 19 - 20 MARCH 2013**

### **1. AGENDA ITEM ONE – Opening of the meeting and adoption of the agenda**

- 1.1 The Scientific Advisory Board Temporary Working Group (TWG) on Verification held its first meeting on 19 to 20 March 2013 at OPCW Headquarters in The Hague.
- 1.2 The meeting was chaired by Professor Roberto Martinez-Alvarez on behalf of the SAB.
- 1.3 The meeting began with Professor Martinez-Alvarez explaining the Terms of Reference (TOR), followed by tour de table to introduce the members of the TWG.
- 1.4 TOR is given in Appendix 1 and the list of TWG members at the meeting is given in Appendix 2.
- 1.5 The following agenda was adopted (topics cover the questions outlined in the TOR):
  - (a) Introduction by TWG chair, round-table introduction, aims and objectives of the TWG, and adoption of the agenda
  - (b) What are the technologies/methodologies used for verification purposes in other international treaties that could benefit the CWC verification regime?
  - (c) Which methodologies (whether existing or new) could assist States Parties in ensuring that all declarable plant sites are identified for declaration?
  - (d) How can sampling and analysis most effectively be utilized for verification purposes?
  - (e) What are the key technical components of a consistent approach to declaring complex mixtures of discrete organic chemicals?
  - (f) Which new or emerging technologies may add value to existing capabilities for verification purposes (such as data analysis/data mining, statistical analysis, attribution analysis)?
  - (g) Which methodologies might be helpful for the Secretariat to keep abreast of developments in science and technology of relevance to the CWC verification regime?
  - (h) Any other business
  - (i) Conclusions, recommendations, plan of action for intersessional period, elaboration of the TWG report and date of the next meeting.

**2. AGENDA ITEM TWO – What are the technologies/methodologies used for verification purposes in other international treaties that could benefit the CWC verification regime?**

- 2.1 The Technical Secretariat (TS) briefed the TWG on the experience of the OPCW in a presentation entitled “Technologies/methodologies used for verification purposes under the CWC”. Boban Cekovic presented the overview of verification activities under Articles IV and V of the CWC (Chemical Weapons verification) and was followed by Miquel Borotau providing an overview of Article VI (Industry) verification activities. The TWG probed the mechanisms for handling discrepancies found during inspections and how to recognize discrepancies. In discussion, the TWG noted that discrepancies are handled by bringing the issue back to the States Parties to address and correct the issue.
- 2.2 Eric Pujol provided a presentation on the International Atomic Energy Agency (IAEA) Safeguard System with an overview of the concepts, technologies, and methods currently in use.
- 2.3 Hermann Lampalzer presented the experience of the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO). The speaker pointed out both some commonalities and differences between the verification regimes established under the CTBT and the Chemical Weapons Convention (CWC).
- 2.4 In discussion of these two presentations, the following points transpired:
- (a) Legal authority is critical for effectiveness of verification.
  - (b) Taking into consideration the confidentiality requirements, the TWG recognized the necessity of collaboration between all units involved in the verification process in order to improve effectiveness.
  - (c) The group acknowledged the benefits of using a wide variety of sources of data and the importance of developing a process for evaluating and validating information for verification purposes.

**3. AGENDA ITEM THREE – Which methodologies (whether existing or new) could assist States Parties in ensuring that all declarable plant sites are identified for declaration?**

- 3.1 Pilar Vita of the TS, presented a summary entitled “Identification of declarable Facilities under CWC”.
- 3.2 Discussion focused on improving the ability of the National Authorities to make complete, accurate, and consistent declarations. In discussion the following transpired:
- (a) Suggestions were made to make better use of the The Electronic Declarations tool for National Authorities (EDNA) and provide the National Authorities with appropriate training as a means to improve quality of declarations.

- (b) TWG members suggested identifying ways and means for States Parties to make use of the information collected for the purpose of submitting declarations in order to ensure that toxic chemicals are not used for prohibited purposes.
- 3.3 Bimal Mehta provided a chemical industry perspective on verification activities. He pointed to factors that would influence the degree of engagement of chemical industry with CWC implementation. The speaker presented an idea of a nationally based system of registration numbers to track all sites to help ensure compliance with the CWC. The speaker further stressed that in order to get the private sector to adhere to the CWC, there needed to be education and outreach to industry as well as those being educated to take careers in the chemical industry.
- 3.4 In discussion the following points transpired:
- (a) The TWG emphasized the need for close collaboration between the industry and National Authorities. The TWG also noted the importance of the OPCW continuing its training and outreach activities.
  - (b) Collaboration with other organizations, e.g. United Nations Environmental program (UNEP), World Health Organization (WHO), in conjunction with international conventions related to chemicals was suggested.
- 4. AGENDA ITEM FOUR – How can sampling and analysis most effectively be utilized for verification purposes?**
- 4.1 Robin Black summarized the work of the TWG on Sampling and Analysis. The recommendations of this TWG were reported in the SAB report to the 3rd Review Conference. Reports from all meetings of the S&A TWG are available on the OPCW website as annexes to relevant SAB.
- 4.2 Hugh Gregg of the TS informed the TWG of the capabilities of the OPCW Laboratory. He described the current protocols and analytical methods used in both on site and off site analysis with GC/MS analysis being the most suitable and useful tool for meeting the requirements of the CWC at this time.
- 4.3 In discussion of these two presentations the following points transpired:
- (a) Good progress is being made in broadening the capability for biomedical sample analysis across the member States through OPCW confidence building exercises.
  - (b) Limitations of OCAD were discussed; further additions to OCAD were strongly recommended to allow the OPCW to meet all its mandated inspection aims.
  - (c) At this time, possibilities to adopt new equipment for on-site chemical analysis were limited.

- (d) The importance of sampling strategies in relation to inspection scenarios, particularly the number of samples required, the selection of sampling points, and selection of appropriate methodologies was noted.

**5. AGENDA ITEM FIVE – What are the key technical components of a consistent approach to declaring complex mixtures of discrete organic chemicals?**

5.1 Mehran Rouzbahani briefed the TWG on issues surrounding declaration of complex mixtures of discrete organic chemicals (DOC). He observed that States Parties take different approaches to declaration of such mixtures and provided six practical examples.

5.2 In discussion the following points transpired:

- (a) The TWG noted the importance of developing a consistent approach by the TS.
- (b) It was noted that this issue would benefit from discussion within the Industry Cluster;
- (c) The TWG would further elaborate on possible technical recommendations to facilitate this discussion.

**6. AGENDA ITEM SIX – Which new or emerging technologies may add value to existing capabilities for verification purposes (such as data analysis/data mining, statistical analysis, attribution analysis)?**

6.1 Per Runn presented several observations to the TWG that spanned the full verification process. He stressed in particular, the importance of information sharing, data analysis, and communication across organizational units. His observations reinforced key points of the discussion of the earlier agenda items.

6.2 In discussion the following point transpired:

- (a) Enhancing the analytical capability of the Verification Information System (VIS) with, for example, the ability to transfer inspection reports into VIS was discussed.

**7. AGENDA ITEM SEVEN – Which methodologies might be helpful for the Secretariat to keep abreast of developments in science and technology of relevance to the CWC verification regime?**

7.1 Jonathan Forman of the TS provided a set of questions for the TWG to consider in order to efficiently identify and track new developments in science and technology. This topic is relevant to all the other agenda items. Furthermore, this would be discussed by the SAB at the next meeting in June 2013.

7.2 In the discussion the following points transpired:

- (a) The TWG acknowledged the benefit of developing a foresight capability to identify new developments that can be used in verification processes.

- (b) Use of professional social media to interact with appropriate experts was suggested.

**8. AGENDA ITEM EIGHT – Any other business?**

- 8.1 No other business was raised.

**9. AGENDA ITEM NINE – Conclusions, recommendations, plan of action for intersessional period, elaboration of the TWG report and date of the next meeting.**

9.1 Subgroups were formed for terms of reference a, b, c, d, and e (of paragraph 4 of the terms of reference of the TWG). The subgroups would progress work prior to the next meeting of the TWG and would provide an update to the TWG chair by 31 May, in order for TWG chair to report progress to the 20th session of the SAB (scheduled to be held in June 2013).

9.2 Each subgroup would prepare a problem statement with possible solutions, and/or alternative strategies, to the TWG chair. The TWG chair would distribute the updates to all TWG members, the updates would be reviewed in subsequent TWG meetings as they become available.

9.3 The second meeting of the TWG was tentatively scheduled for 23-24 September, 2013.

**10. AGENDA ITEM TEN – Closure of the meeting.**

10.1 The Chairperson closed the meeting at 16:40 on 20 March 2013.

Appendices:

Appendix 1: Terms of Reference of the Temporary Working Group on Verification.

Appendix 2: List of Participants in the First Meeting of the Temporary Working Group on Verification.

## Appendix 1

### **TERMS OF REFERENCE<sup>10</sup> OF THE TEMPORARY WORKING GROUP ON VERIFICATION**

1. Verification-related issues with scientific and technological dimensions have arisen over recent years. The Director-General has decided that in-depth study by the Scientific Advisory Board (SAB) is necessary. Further to his response to the report from the Nineteenth Session of the SAB, and in accordance with paragraph 9 of the terms of reference of the SAB, the Director-General has therefore established a Temporary Working Group (TWG) on Verification and has appointed Roberto Martinez-Álvarez as the Chairperson of the group.
2. The objective of the TWG is to consider questions relating to verification, in particular those which fall under paragraphs 2 (e)<sup>11</sup> and 2(g)<sup>12</sup> of the SAB's terms of reference, and to make recommendations to the SAB.
3. The TWG will consist of individuals who collectively have expertise in the theory and practice of verification, in the chemical weapons and industry dimensions of verification, or experience with the implementation of the CWC. Qualified members of the SAB may join the TWG. Members of relevant scientific organisations and international organizations may also be invited to join the TWG. Guest speakers may be invited from time to time. The TWG may also, when necessary, draw upon the expertise of the Technical Secretariat.
4. Reporting to the SAB, the TWG will in particular answer the following questions:
  - (a) What are the technologies/methodologies used for verification purposes in other international treaties that could benefit the CWC verification regime?
  - (b) Which methodologies (whether existing or new) could assist States Parties in ensuring that all declarable plant sites are identified for declaration?
  - (c) What are the key technical components of a consistent approach to declaring complex mixtures of discrete organic chemicals?
  - (d) How can sampling and analysis most effectively be utilized for verification purposes?
  - (e) Which new or emerging technologies may add value to existing capabilities for verification purposes (such as data analysis/ data mining, statistical analysis, attribution analysis)?

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<sup>10</sup> Approved by the Director-General on 20 December 2012

<sup>11</sup> "... assess the scientific and technological merit of a present, or proposed, methodology for use by the Technical Secretariat in verification under the Convention"

<sup>12</sup> "assess and report on emerging technologies and new equipment which could be used on verification activities"

- (f) Which methodologies might be helpful for the Secretariat to keep abreast of developments in science and technology of relevance to CWC verification regime?
5. In addition, the TWG will provide advice on Secretariat proposals for technologies and equipment for verification purposes.
  6. The Director-General might pose other relevant questions to the TWG, through the SAB.
  7. The temporary working group will exist for a period of three years from the date of its first meeting. Thereafter its work will be reviewed by the SAB and the Director-General, and a decision will be made as to whether it should continue its work, and, if so, whether the Terms of Reference should be revised.

## Appendix 2

**LIST OF PARTICIPANTS<sup>13</sup> IN THE FIRST MEETING  
OF THE SAB TEMPORARY WORKING GROUP ON VERIFICATION  
THE HAGUE, THE NETHERLANDS  
19 – 20 MARCH 2013**

<b>Participant</b>	<b>Institution</b>
Dr Roberto Martinez-Alvarez <sup>14</sup>	Universidad Complutense de Madrid
Dr Robin Black	Defence Science and Technology Laboratory (DSTL), Porton Down
Mr Julius Kozma	Consultant
Mr Hermann (Alex) Lampalzer	Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO)
Mr Bimal Mehta	Transpek Industry Ltd., Vadodara
Dr Nicia Maria Fusaro Mourao	ABIQUIM (Brazilian Chemical Industry Association), São Paulo
Dr Daan Noort	Netherlands Organisation for Applied Scientific Research (TNO)
Mr Eric Pujol	International Atomic Energy Agency (IAEA)
Mr Mehran Rouzbahani	Consultant
Dr Per Runn	Consultant
Ms Mui Tiang Sng	DSO National Laboratories, Singapore
Professor Paula Vanninen	Finnish Institute for Verification of the Chemical Weapons Convention, University of Helsinki
Mr Francois Mauritz van Straten	South African Nuclear Energy Corporation SOC Ltd, Pretoria
Dr Rob Visser	Consultant

<sup>13</sup> Michael Walls (American Chemistry Council) and Stefan Mogl (Spiez Laboratory, Switzerland) could not attend the first meeting of the TWG.

<sup>14</sup> Chairman of the TWG on Verification.

## Annex 4

### **DIRECTOR-GENERAL'S REQUEST TO THE SCIENTIFIC ADVISORY BOARD TO CONSIDER WHICH RIOT CONTROL AGENTS ARE SUBJECT TO DECLARATION UNDER THE CHEMICAL WEAPONS CONVENTION**

1. States Parties are required to declare riot control agents (RCAs) in accordance with Article III(1)(e) of the Chemical Weapons Convention (CWC or Convention).<sup>15</sup>
2. The Director-General wishes to assemble an indicative list of substances that the Secretariat currently considers as RCAs. Such a list, which would not be exhaustive, will be made available to States Parties as a point of reference in support of their declarations.
3. The CWC provides that “riot control agent” means “any chemical not listed in a Schedule, which can produce rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination of exposure” (Article II(7)). However, the definition of RCAs in the Convention leaves some room for interpretation as to which chemicals can be considered as meeting the requirement specified in Article II(7).
4. An initial list has been developed by the Technical Secretariat, based on the following criteria:
  - (a) All the RCAs that have been declared since entry-into-force of the CWC;
  - (b) Previous advice by the Scientific Advisory Board (SAB): in 2001 the SAB’s Temporary Working Group (TWG) on Analytical Procedures drew up a list of “riot-control agents and old/abandoned chemical weapons” to be considered for inclusion in the OCAD, which the SAB in principle endorsed (cf. paragraphs 2.4-2.5 and Annexes 3 and 4 of SAB-IV/1, in which the SAB focused on the compounds that the Board thought should be incorporated into the OPCW OCAD with the highest priority); and
  - (c) An initial survey conducted by the Technical Secretariat in 2013 of RCAs that have been researched or are available for purchase, beyond those that are already declared.
5. The Director-General requests the Scientific Advisory Board to consider the attached initial list of riot-control agents that have been declared by States Parties, researched, or that are available for purchase, and requests the Board to provide technical advice on:
  - (a) Whether the list reflects the current riot-control agents that could be considered as declarable in accordance with Article III(1)(e); and, in particular

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<sup>15</sup> Article III(1)(e) provides that, with respect to RCAs, States Parties shall “specify the chemical name, structural formula and Chemical Abstracts Service (CAS) registry number, if assigned, of each chemical it holds for riot control purposes. This declaration shall be updated not later than 30 days after any change becomes effective.”

- (b) The soundness of the criteria used by the Secretariat in drawing up the initial list;
- (c) Which other considerations or criteria, if any, should be used in developing the list;
- (d) Which chemicals, if any, should be added to the list

Technical Secretariat  
June 2013

## **Annex 5**

### **REPORT OF THE SECOND MEETING OF THE SAB TEMPORARY WORKING GROUP ON EDUCATION AND OUTREACH IN SCIENCE AND TECHNOLOGY RELEVANT TO THE CHEMICAL WEAPONS CONVENTION THE HAGUE, THE NETHERLANDS 22 - 24 NOVEMBER 2012**

#### **1. AGENDA ITEM ONE – Opening of the meeting and adoption of the agenda.**

- 1.1 The Temporary Working Group (TWG) on Education and Outreach of the Scientific Advisory Board (SAB) held its second meeting on 22 to 24 November 2012 at OPCW Headquarters in The Hague.
- 1.2 The meeting was chaired by Professor Djafer Benachour on behalf of the SAB.
- 1.3 The list of participants in the meeting is given in the Appendix attached hereto.
- 1.4 The following agenda was adopted:
  1. Introduction by TWG chair and adoption of the agenda
  2. Reports from members on intersessional work
  3. Pilot project to develop educational material: progress report and next steps
  4. OPCW activities
  5. Interaction with the 14th annual meeting of National Authorities
  6. Engaging national entities: a potential model
  7. Responsible conduct of research
  8. Education and outreach at the Third Review Conference
  9. Engagement with other relevant stakeholders
  10. Topics for intersessional work and dates of the next meetings
  11. Any other business
  12. Summary of conclusions and recommendations and elaboration and adoption of the TWG report
  13. Closure of the meeting

#### **2. AGENDA ITEM TWO – Reports from members on intersessional work.**

- 2.1 Djafer Benachour briefed the TWG on a meeting in Amman, Jordan which he attended in July 2012. The purpose of the meeting was to elaborate a code of conduct

for chemists in the Middle East. Professor Benachour said that the meeting was positive and a draft code of conduct had been produced which was now being discussed within the chemistry communities in the respective countries. He highlighted the fact that the Chemical Weapons Convention (hereinafter “the Convention”) was specifically referred to in the draft code and that elements of it were based upon the guidelines for codes of conduct prepared earlier by IUPAC.<sup>16</sup>

- 2.2 Djafer Benachour, Jan Apotheker, Peter Mahaffy and Soon Ting-Kueh reported to the TWG on the 22nd International Conference on Chemistry Education (ICCE) in July 2012 in Rome which they had all attended. The ICCE was attended by over 600 chemistry educators from over 70 countries. Before the conference, Professor Benachour also participated in a meeting of IUPAC’s Committee on Chemistry Education (CCE) and gave a presentation about the work of the TWG. He noted that he received a warm response from the CCE. Jan Apotheker informed the TWG that the CCE has set up a project group on the OPCW. At the CCE meeting, it was suggested that the OPCW should regularly participate in CCE meetings. The members of the TWG endorsed this idea and Mr Apotheker in consultation with the Secretariat will take it up with IUPAC. It was further suggested that the relationship should be mutual and IUPAC should regularly brief the SAB on relevant activities. Furthermore, the TWG recommended that the OPCW should participate in the 23rd ICCE which will take place in Toronto in July 2014.
- 2.3 Professor Alejandra Suárez reported on her participation in an OPCW workshop on Article XI of the Convention in Montevideo in October 2012. While some good educational materials have been produced, she noted that many National Authorities are not well connected to their domestic education and science communities. Within the Latin American and Caribbean region, Professor Suárez suggested focusing on university students and scientific associations with the aim of creating networks within States Parties.

**3. AGENDA ITEM THREE – Pilot project to develop educational material: progress report and next steps.**

- 3.1 At its first meeting, the TWG identified a need for educational materials on the multiple uses of chemicals and the role of the Convention. However, such materials need to be targeted and designed differently depending on the level of education. In the context of the multiple uses of chemicals, students should learn about responsible conduct, the use of chemicals in combat and the Convention in ways that are appropriate to their age and educational setting and to their academic and career needs.
- 3.2 Jan Apotheker updated the TWG on a pilot project to develop educational materials on the OPCW and the Convention for high school students, in response to a recommendation by the TWG at its first meeting. Mr Apotheker had assembled a group of educators in the Netherlands willing to work on the production of educational materials for teachers to use in chemistry lessons. Daniel Feakes of the

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<sup>16</sup> Graham S. Pearson,\* Edwin D. Becker, and Leiv K. Sydnes, “Why Codes of Conduct Matter”, Chemistry International, Vol. 33 No. 6, November-December 2011, available at [http://www.iupac.org/publications/ci/2011/3306/2\\_pearson.html](http://www.iupac.org/publications/ci/2011/3306/2_pearson.html).

Technical Secretariat informed the TWG that the United Kingdom of Great Britain and Northern Ireland had recently made a voluntary contribution to the SAB Trust Fund, part of which is intended to support this project.

- 3.3 TWG members stressed that it is also important to develop educational materials for university students and educators. Professor Suárez reported on a planned initiative in Argentina to develop such materials.

**4. AGENDA ITEM FOUR – OPCW Activities.**

- 4.1 Daniel Feakes gave a short presentation on relevant activities of the Secretariat since the first meeting of the TWG. Such activities included a meeting with think tank experts in June at which education and outreach was discussed, the launch of e-learning modules on the OPCW public website, and events to mark the fifteenth anniversary of the OPCW on 3 September 2012, some of which focused on education and outreach. In addition, Mr Feakes informed the TWG that the Director-General has also raised education and outreach in bilateral meetings and had given a keynote speech at the ICCE in Rome (see paragraph 2.2 above) and he had also given the John Gee Memorial Lecture at Australian National University in Canberra, also in July.

**5. AGENDA ITEM FIVE – Interaction with the fourteenth annual meeting of National Authorities.**

- 5.1 This meeting of the TWG took place in conjunction with the fourteenth annual meeting of National Authorities (NAs), in response to a recommendation of the first meeting of the TWG that the interaction with NAs be strengthened. Of six breakout groups at the annual meeting, one was on “education and outreach in science and technology”. TWG members Bob Mathews, Alastair Hay and Peter Mahaffy led an interactive session with the participating National Authority personnel exploring how NAs may benefit from, and contribute to, enhanced education and outreach efforts. Professors Hay and Mahaffy presented the conclusions and recommendations of the breakout group to a plenary session of the NA meeting. The other breakout groups also made presentations, some of which also drew attention to relevant issues such as a lack of awareness of the Convention among domestic stakeholders and proposed possible remedies such as outreach programmes to companies and NA “engagement days” to connect with stakeholders.

- 5.2 Subsequently, Professors Hay and Mahaffy gave a presentation to the NA meeting highlighting the importance of education and outreach to the implementation of the Convention. They gave examples of the potential target audiences of education and outreach activities, for example: The 18-year-old student who will be a politician, scientist, or NA member in 30 years; the young researcher making specialty organic chemicals for her PhD thesis; and the sales manager of a local chemical supplier. NAs need to know each audience and education and outreach needs to be matched to what each needs to know. The presentation also highlighted challenges, particularly for teachers and students, for example: Relevance to and ownership by students and teachers in many countries – “The Convention is someone else’s responsibility”; concerns of negative impact on public image of chemistry; knowledge base of chemistry teachers at all levels about the issue; content in chemistry is often taught in

isolation from contexts; little formal attention to ethical issues in curriculum; and remoteness of Convention structure to educational systems. The presentation stimulated many positive comments from several NAs from different regional groups noting the importance of education and outreach to the future of the Convention. There was discussion about how the OPCW and NAs can jointly strengthen future education and outreach efforts.

- 5.3 Based on its interactions with the NAs, and on the feedback from NA representatives, the TWG is of the view that education and outreach should be seen as an essential part of national implementation. Education and outreach should not be seen as another task for NAs to undertake, but as a tool to enable them to carry out their functions more effectively. The TWG will explore the development of a “toolkit” to assist NAs in conducting needs assessments and of guidance on running workshops to engage with domestic stakeholders. It would be useful to include education and outreach on the agenda of future NA meetings, including those held in regions.

## **6. AGENDA ITEM SIX – Engaging national entities: a potential model.**

- 6.1 A guest presentation was given by Masamichi Minehata of the University of Bradford in the United Kingdom. The presentation demonstrated action plans, developed by the University of Bradford, to achieve strategic objectives set out in the Final Document of the BWC Meeting of States Parties in 2008. The action plans included the following:

- (a) Conducting country surveys of life science degree courses to investigate the current state of biosecurity education at universities in Europe, the Middle East and the Asia-Pacific region;
- (b) Developing online educational material to mitigate the lack of textbooks;
- (c) Developing a train-the-trainer programme to mitigate the lack of teachers;
- (d) Developing country specific educational material for short courses to help facilitate the development of national biosecurity experts networks; and
- (e) Reporting activities back to the BWC.

- 6.2 Mr Minehata noted that education and awareness-raising efforts by BWC States Parties are well documented in working papers submitted to the Seventh BWC Review Conference. Mr Minehata said that these examples can help States Parties understand how educators can enhance their own understanding about biosecurity issues. They should also help States Parties understand how to then disseminate knowledge through developing their own customised and tailored education programmes within their own life science communities, being cognizant of the principle that “no one size fits all”. Mr Minehata said that education for life scientists, policy-makers and other stakeholders about social responsibility on dual-use issues is easily achievable and need not be expensive, time-consuming or over-burdening.

- 6.3 Subsequent discussion within the TWG noted that outreach efforts in some States Parties have demonstrated the need for a coherent approach to domestic stakeholders

by governments, for example by covering the Convention, BWC and export controls together rather than separately. TWG members also highlighted the importance of BWC States Parties reporting back on their experiences, both positive and negative, in conducting education and outreach activities.

## **7. AGENDA ITEM SEVEN – Responsible conduct of research.**

- 7.1 TWG members discussed the growing number of national and international initiatives on the responsible conduct of research (RCR). In many situations, it might be most effective to introduce information on the OPCW and the Convention in the context of RCR, rather than through specific stand-alone courses. Jo Husbands, Alastair Hay and Jan Apotheker each described various reports or meetings on RCR, and identified it as an area in which information on the Convention could be introduced. This was already happening with information on the BWC being introduced into discussions on RCR in the life sciences. Peter Mahaffy noted that Statute 5 of the International Council for Science (ICSU) states that the free and responsible practice of science “requires responsibility at all levels to carry out and communicate scientific work with integrity, respect, fairness, trustworthiness, and transparency, recognising its benefits and possible harms.” The OPCW could work with ICSU in order to engage in the global debate on RCR. Opportunities for such engagement could be the Third World Conference on Research Integrity in May 2013 in Montreal and the World Science Forum in Rio de Janeiro in November 2013.
- 7.2 Jo Husbands introduced a survey of codes of conduct from professional chemistry societies and ethics codes from trade associations, industry, government and academia. Of the 40 codes surveyed, only one clearly stated that members cannot provide materials or expertise to create a chemical weapon. While others had language about ethics, safety and environmental responsibility, only two referred specifically to security practices and principles. Although unable to attend the TWG meeting, Detlef Männig circulated examples of several codes of conduct from professional associations and the chemical industry. TWG members agreed that incorporating reference to the Convention into existing and new chemistry codes of conduct could be a mechanism for increased outreach, and should therefore be explored further.

## **8. AGENDA ITEM EIGHT – Education and outreach at the Third Review Conference.**

- 8.1 It was noted that the final reports from the First and Second Review Conferences did not contain specific references to education, although they did contain general statements about the value of awareness-raising. In contrast, past BWC Review Conferences and Meetings of States Parties have made specific mention of education, and BWC States Parties have submitted several national papers on the topic. For example, the Seventh BWC Review Conference noted that oversight, education, awareness-raising and codes of conduct have a role to play in preventing the misuse of biological agents. In addition, a group of 11 BWC States Parties submitted a working paper on possible approaches to education and awareness-raising among life

scientists.<sup>17</sup> TWG members recommended that States Parties should discuss approaches to education and outreach at the Third Review Conference and that appropriate language should be included in its final report. They also encouraged States Parties to share their own experiences, perhaps through the submission of national papers. Such experiences could also be shared at a side event organised during the Third Review Conference.

## **9. AGENDA ITEM NINE – Engagement with other relevant stakeholders.**

- 9.1 Daniel Feakes from the Secretariat gave a short presentation on the “disarmament and non-proliferation education” activities of the United Nations Office of Disarmament Affairs (UNODA). In 2001, the UN Secretary-General had requested a group of governmental experts to undertake a study of disarmament and non-proliferation education around the world. The group reported in 2002 and its report was submitted to the General Assembly (A/57/124 dated 30 August 2002). Since then, every two years the Secretary-General has submitted a report and the First Committee has adopted an unopposed resolution. These biennial reports contain submissions from Member States and relevant international organisations, including the OPCW, concerning their activities in this area. UNODA has a disarmament education website, convenes an inter-agency meeting between relevant international organisations and periodically offers training to local educators. The TWG noted that the information on the UNODA website is mainly targeted at diplomats and students of political science and suggested that a section could be created for science students.
- 9.2 Peter Mahaffy briefed the TWG on the activities of the ICSU Committee for Freedom and Responsibility in the conduct of Science (CFRS). In the context of the Principle of the Universality of Science and the role that it plays in addressing both the freedoms and responsibilities of science and scientists, CFRS has considered how it might address the topic of Science and War, especially in the context of fourth generation war, which is the type of conflict that poses the greatest threat for the use of chemical and biological weapons. There has been some discussion in CFRS about holding a workshop on this topic to raise awareness of the global scientific community, perhaps in partnership with the Pugwash Conferences on Science and World Affairs. The TWG might explore possibilities for building synergy with this initiative, and express its views to CFRS on whether joint involvement in a workshop might be of interest.
- 9.3 Peter Mahaffy also briefed the TWG on the Malta Conferences. These events, of which there have been five to date, are designed to bring together chemists from countries in areas of tension, particularly those from the Middle East. The sixth Malta Conference is scheduled to take place in November 2013 and Professor Mahaffy reported that the organisers are interested in including issues relating to the Convention on its agenda.
- 9.4 Peter Mahaffy and Jan Apotheker briefed the TWG on the activities of IUPAC, particularly its standing committees on chemistry education (CCE) and the chemical

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<sup>17</sup>

See BWC/CONF.VII/WP.20/Rev.1, available at  
<http://daccess-ods.un.org/access.nsf/Get?Open&DS=BWC/CONF.VII/WP.20/Rev.1&Lang=E>.

industry (COCI). The TWG recommended that the OPCW should be present at the IUPAC General Assembly and World Chemistry Congress in Istanbul in August 2013 which present a significant opportunity to engage with the global chemistry community. A number of ways in which OPCW could participate were put forward and will be taken up by the Secretariat in consultation with the TWG.

- 9.5 Soon Ting-Kueh informed TWG members of the 15th Asian Chemical Congress in Singapore in August 2013 and the possibility of arranging a half-day workshop on the Convention. The Secretariat will explore options with the organisers.
- 9.6 Several TWG members referred to the format of the annual BWC Meetings of Experts. The structured nature of this process creates opportunities for the scientific community to engage with the BWC and its States Parties on issues relating to science and technology, including education, awareness-raising and codes of conduct. The TWG believes that similar meetings in The Hague might be a useful way to engage the global scientific community in OPCW discussions on scientific and technological topics.

**10. AGENDA ITEM TEN – Topics for intersessional work and dates of the next meetings.**

- 10.1 The future work of the TWG will be focused on the areas outlined below:
  - (a) Creating Educational Materials and Demonstration Projects:
    - (i) Updating IUPAC “Multiple Uses of Chemicals” materials to reflect advances in education technology (e.g., video)
    - (ii) Undertaking a pilot project on “Chemistry in Conflict” for high school students in the Netherlands
    - (iii) Seeking support for demonstration project at university level (e.g., in Argentina)
  - (b) Building and Strengthening Partnerships
    - (i) With other non-proliferation and disarmament organisations: BWC (in particular, given convergence), UNODA, CTBTO
    - (ii) With IUPAC, Especially CCE
    - (iii) With other international science bodies, ICSU, especially CFRS
  - (c) Reaching out to the Scientific Community
    - (i) Calendar of relevant activities
    - (ii) Special events/ appearances by the Director-General at scientific meetings: IUPAC General Assembly 2013, 15th Asian Chemical Congress
  - (d) Undertaking Broader Outreach

- (i) For centenary of the First World War in 2014 and of the first use of chemical weapons in 2015
  - (ii) Focus on science museums/special events and exhibits
  - (iii) Promoting IUPAC materials
  - (iv) Strategic plan to increase use
  - (v) Promoting responsible conduct
  - (vi) Project on codes of conduct
  - (vii) Embed chemical weapons issues in broader projects (e.g., IAC/IAP, others)
- (e) Engaging Industry
- (i) Around what's new or changing (i.e., trends in science and technology, production, diffusion)
  - (ii) Supporting education and outreach capacity
  - (iii) Toolkit for national needs assessment by/for National Authorities
  - (iv) Cross-WMD aggregating website
  - (v) Dedicated sections on existing websites
- 10.2 A date for the third meeting of the TWG was not fixed, but it was suggested that one option would be for it to take place adjacent to another meeting at which several TWG members would be present, for example the IUPAC meetings in Istanbul or the Asian Chemistry Congress in Singapore. A date will be decided upon in consultation between the TWG Chairperson and the Secretariat.
- 11. AGENDA ITEM ELEVEN – Any other business.**
- 11.1 None.
- 12. AGENDA ITEM TWELVE – Summary of conclusions and recommendations and elaboration and adoption of the TWG report.**
- 12.1 The following is a summary of the main conclusions and recommendations of the second meeting of the TWG:
- (a) The OPCW should participate in future meetings of the IUPAC CCE and should use the IUPAC meetings in Istanbul in August 2013 as an important awareness-raising opportunity;
  - (b) The TWG will continue to provide support to the project to develop educational materials for high school students in the Netherlands and will provide support to future projects to develop educational materials for university students;
  - (c) The TWG very much appreciated the opportunity to interact with the 14th annual NA meeting and recommends that education and outreach be included on the agenda of future NA meetings, including those at the regional level;

- (d) The TWG recommends that education and outreach is seen as an essential element of national implementation and is of the view that it will play an important role in preventing the misuse of toxic chemicals;
- (e) The TWG believes that there are important lessons for the OPCW from education and outreach activities under the BWC, for example the utility of “train the trainer” programmes, the value of States Parties reporting on their experiences of education and outreach and the opportunities provided for interaction with the scientific community by structured meetings. The OPCW should therefore strengthen its interaction with the BWC;
- (f) The TWG views the responsible conduct of research as a very useful context in which to raise the multiple uses of chemicals and awareness of the Convention. To this end, the OPCW should engage with ICSU and other relevant actors;
- (g) The TWG will continue to study the utility of codes of conduct in different settings;
- (h) States Parties should discuss education and outreach in the context of the Third Review Conference, for example through national papers and side events, and the TWG encourages the inclusion of appropriate language on the importance of education and outreach in the final report of the Review Conference;
- (i) The TWG recommends the OPCW to continue its interactions with external stakeholders such as UNODA and IUPAC, while TWG members will assist in establishing new interactions, for example with ICSU;
- (j) The TWG briefly discussed potential OPCW involvement in the centenary of the First World War in 2014 and the centenary of the first use of chemical weapons in 2015. TWG members recognised that anniversaries such as these can play an important role in raising awareness among target audiences and recommended the OPCW actively considers ways in which to make best use of them.

### **13. AGENDA ITEM THIRTEEN – Closure of the meeting.**

13.1 The Chairperson closed the meeting at 10:50 on 24 November 2012.

Appendix: List of Participants in the Second Meeting of the Temporary Working Group on Education and Outreach in Science and Technology Relevant to the Chemical Weapons Convention.

## Appendix

**LIST OF PARTICIPANTS IN THE SECOND MEETING OF THE TEMPORARY  
WORKING GROUP ON EDUCATION AND OUTREACH IN SCIENCE AND  
TECHNOLOGY RELEVANT TO THE CWC  
THE HAGUE, THE NETHERLANDS<sup>18</sup>  
22 – 24 NOVEMBER 2012**

<b>Participant</b>	<b>Institution</b>
Apotheker, Jan	University of Groningen, the Netherlands
Benachour, Djafer <sup>19</sup>	Ferhat Abbas University, Ministry of Higher Education and Scientific Research, Setif, Algeria
Engida, Temechgn	Addis Ababa University, Ethiopia
Hay, Alastair	University of Leeds, United Kingdom
Husbands, Jo	National Academy of Sciences, Washington, D.C., United States of America
Mahaffy, Peter	The King's University College, Edmonton, Canada
Mahdi Balali-Mood	Medical Toxicology Centre, Imam Reza Hospital, University of Medical Sciences, Mashhad, Islamic Republic of Iran
Mathews, Robert	Defence Science and Technology Organisation, Melbourne, Australia
Mogl, Stefan	Spiez Laboratory, Switzerland
Soon, Ting-Kueh	Malaysian Institute of Chemistry, Kuala Lumpur, Malaysia
Suárez, Alejandra Graciela	Universidad Nacional de Rosario, Argentina

<sup>18</sup> Detlef Männig (Evonik Industries AG, Germany) and Philip Coleman (Protechnik Laboratories, South Africa) could not attend the second meeting of the TWG.

<sup>19</sup> Chairman of the TWG.

## **Annex 6**

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

1. Article X establishes the obligations and rights of a State Party concerning the Assistance and Protection against Chemical Weapons, and accords each State Party the right to request and to receive assistance and protection against the use or threat of use of chemical weapons. It is anticipated that, in most cases, the main assistance needed from the OPCW would be provision of medical countermeasures and treatment for chemical weapons casualties.
2. At its sixteenth session (in 2011) the Conference of States Parties to the Chemical Weapons Convention (CWC) established the international support network for the victims of chemical weapons. This decision requires the establishment of a webpage and a databank to include information on offers by Member States relevant to the victims of chemical weapons and information on needs of the victims of chemical weapons. In order to be in a position to fully meet the expectations of CWC States Parties with regard to the victims' network, it is necessary for the Technical Secretariat to compile information on relevant scientific advances with respect to new medical countermeasures and treatments of victims of nerve and blister agents.
3. In its report on developments in science and technology to the 3rd CWC Review Conference (cf. paragraphs 120-123 in RC-3/DG.1, dated 29 October 2012), the Scientific Advisory Board informed the Technical Secretariat on the status of currently available countermeasures and treatments. As a follow up to this information, the Director-General requests the Scientific Advisory Board to:
  - (a) recommend to the Technical Secretariat pre-treatments, vaccines, emergency care, and long term treatments that are currently available for blister and nerve agents; and
  - (b) to inform the Technical Secretariat of the most relevant information sources that can be monitored to keep abreast of new developments in these areas.

Technical Secretariat

June 2013

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