



**REPORT OF THE SCIENTIFIC ADVISORY BOARD
AT ITS THIRTY-FIRST SESSION**

1. AGENDA ITEM ONE – Opening of the session

- 1.1 The Scientific Advisory Board (SAB) met virtually for its Thirty-First Session from 3 to 4 March 2021 via the Microsoft Teams platform. The session was chaired by Dr Christophe Curty, with Dr Andrea Leisewitz serving as Vice-Chairperson.

Executive summary

- 1.2 Due to the current coronavirus (COVID-19) pandemic, this SAB meeting was conducted entirely in a virtual format.
- 1.3 This session focused on current and upcoming SAB activities, including preparations for the Fifth Review Conference,¹ the newly established Temporary Working Group (TWG) on the analysis of biotoxins, planning for upcoming workshops, and renewing and fostering relationships with external partners. Dr Zrinka Kovarik and Dr Mostafa Ghanei presented their relevant research in the health effects of chemical weapons and countermeasures thereto. In addition, the Board received updates from Technical Secretariat (hereinafter “the Secretariat”) staff, and from representatives of the Advisory Board on Education and Outreach (ABEO).

2. AGENDA ITEM TWO – Adoption of the agenda

The SAB adopted the following agenda for its Thirty-First Session:²

1. Opening of the session
2. Adoption of the agenda
3. *Tour de table*
4. Establishment of a drafting committee
5. Welcome address by the Director of the Office of Strategy and Policy

¹ The Fifth Conference of the States Parties to Review the Operation of the Chemical Weapons Convention.

² It should be noted that while presentations and agenda items are grouped in this report based on topic matter, they were not always presented sequentially as listed due to scheduling considerations of the presenters.



6. Overview of developments at the OPCW since the last session of the Scientific Advisory Board
7. The International Union of Pure and Applied Chemistry and its role and activities in scientific and educational applications of chemistry
8. Effects of chemical weapons on human health and countermeasures against them
 - (a) New insights on countermeasures against nerve agent poisoning
 - (b) National health planning following chemical weapons injuries
9. Statement on behalf of the OPCW Advisory Board on Education and Outreach
10. Current and future activities of the Scientific Advisory Board
 - (a) Temporary Working Group on the analysis of biotoxins
 - (b) Planning and preparing for the Fifth Review Conference
 - (c) Efforts towards a workshop in partnership with industry
11. Any other business
12. Adoption of the report
13. Closure of the session

3. AGENDA ITEM THREE – *Tour de table*

An opportunity was given for SAB members to take the floor to introduce themselves.

4. AGENDA ITEM FOUR – Establishment of a drafting committee

The SAB Secretary asked for volunteers to contact him or the SAB Chair if interested in being on the drafting committee to prepare the report of the SAB's Thirty-First Session.

5. AGENDA ITEM FIVE – Welcome address by the Director of the Office of Strategy and Policy

- 5.1 The Director of the Office of Strategy and Policy (OSP), Ms Veronika Stromšíková, delivered opening remarks. She welcomed the members of the SAB and expressed appreciation for an opportunity to meet them, particularly the seven newer members of the Board, albeit only virtually. She further noted that her update would focus on two main issues: the current situation and the OPCW operational posture during the COVID-19 pandemic, and the unique role of the SAB at the OPCW.
- 5.2 Reflecting on the first issue, the OSP Director informed the Board that since the outbreak of the pandemic, the Secretariat has been operating mostly remotely, managing to deliver on all of its mandates. She did mention that certain activities are still being conducted in person, such as monitoring the process of chemical weapons destruction in the United States and conducting deployments of non-routine missions

to the Syrian Arab Republic. Other activities, such as capacity building and international cooperation programmes, continue in an online format. The policy-making organs have been conducting hybrid meetings combining restricted in-person attendance with observers following the meetings online.

- 5.3 Turning to the role of the SAB and its continued importance to the OPCW, the OSP Director said that the OPCW has recently conducted a thorough examination of its mission in future, especially once the United States stockpile is fully eliminated, which is expected to happen in 2023. It was concluded that the Secretariat will continue to adapt and evolve to meet its continued mission under the auspice of the Chemical Weapons Convention (hereinafter “the Convention”), while ensuring that emerging relevant areas are integrated as appropriate. The Secretariat must therefore continue to consider the science and technology applicable to the Convention, and must keep abreast of the developments in science and technology in order to adapt appropriately. States Parties have clearly recognised this from the start, as the SAB is the only advisory board that has its own provision in a disarmament convention. Moreover, in order to preserve the independence of the SAB and its advice, the States Parties are not directly involved in the dialogue between the SAB and the Director-General, apart from noting the Director-General’s response to SAB reports. Another important element of the SAB’s advice is its provision of a comprehensive review of developments in science and technology for the OPCW’s Review Conferences. She confirmed to the Board that the next Review Conference is expected to take place in 2023. She noted that while the scientific report that the SAB prepared for the Fourth Review Conference was extremely comprehensive, she supports the view of the Board to focus on a limited number of areas of specific relevance for the next Review Conference.
- 5.4 The Director of the OSP then opened the floor to any comments or questions from the Board. The Chairperson of the SAB remarked that the SAB remained committed to preparing a relevant scientific report for the Fifth Review Conference. He then asked for further information on the impact of the COVID-19 pandemic on the OPCW’s industry verification efforts. The OSP Director noted that the OPCW was not able to carry out all 241 industry inspections as it normally would in 2020, and the same situation is expected in 2021. She clarified that the OPCW had to take into account not only the situation in respective countries of travel, but also regulations in the OPCW’s host country, the Netherlands. Due to the Dutch authorities’ appeal to limit travel to the absolute minimum, a decision was reached not to plan any non-essential industry inspections until at least the end of March 2021. She elaborated that inspections of old chemical weapons and abandoned chemical weapons were also put on hold for the foreseeable future.
- 5.5 It was then noted that the issue of limited industry inspections has indeed been reiterated within some States Parties. It was then asked whether the OPCW has considered the possibility of conducting virtual or remote inspections, even if in a limited extent (such as checking and verifying reported numbers and lists). The OSP Director agreed that the capability to conduct virtual inspections, even in a partial manner, is one that should be further explored within the Secretariat and with States Parties. However, the current arrangements do not allow for these alternatives. Lastly, the Board asked how certain planned OPCW activities, such as the annual Associate Programme and the accompanying industry component thereof, would continue in 2021 given the ongoing COVID-19 restrictions. The OSP Director responded that many activities planned

in 2021, including the Associate Programme, would need to adapt to limited physical travel and engagement, as was the case in 2020. To that end, it was appreciated that the Secretariat should continue to investigate innovative methods through which capacity-building activities can continue.

6. AGENDA ITEM SIX – Overview of developments at the OPCW since the last session of the Scientific Advisory Board

6.1 The Secretariat's Senior Science Policy Officer and Secretary to the SAB briefed the Board on developments at the OPCW since the SAB's Thirtieth Session.

6.2 The SAB Secretary highlighted news relevant to the SAB with regard to OPCW meetings and sessions, including the convention and suspension of the Twenty-Fifth Session of the Conference of the States Parties and the upcoming Ninety-Sixth Session of the Executive Council. He reiterated that it had been agreed to split the Twenty-Fifth Session of the Conference in two parts due to concerns over the COVID-19 pandemic. The Conference is meant to resume by the end of April, and it is envisaged that the previously planned topics will be considered. In addition, he noted that the topic of central nervous system-acting (CNS-acting) chemicals is to be debated again at the upcoming Ninety-Sixth Session of the Executive Council.

6.3 The SAB Secretary briefly noted the report from the SAB's Thirtieth Session, and the Director-General's response, highlighting the importance of the SAB's work and recommendations, and the appreciation the Director-General has for the SAB's efforts.

6.4 The SAB Secretary then turned to SAB-associated matters, highlighting the number of opportunities where Board members have assisted OPCW projects and been sought as experts on various matters, both internally at the OPCW and in the external non-proliferation and disarmament arena. He again thanked the Board for their numerous contributions beyond general participation at SAB sessions and encouraged members to continue to send updates to the SAB Secretary about their achievements and participation in relevant events.

6.5 Lastly, the SAB Secretary noted that both the "Call for Voluntary Contributions to the Trust Fund of the Scientific Advisory Board" (S/1923/2021, dated 14 January 2021) and the "Call for Nominations to the Scientific Advisory Board" (S/1927/2021, dated 26 January 2021) have been published. He particularly noted the latter, encouraging Board members to reach out to their colleagues across the globe to let them know that the Director-General is seeking nominations from States Parties of experts to be appointed to the Board starting 1 January 2022. The SAB Chairperson corroborated the Secretary's views that the Board should feel empowered to communicate with their colleagues to ensure that visibility of the opportunity to be nominated to the OPCW SAB is as high as possible.

7. AGENDA ITEM SEVEN – The International Union of Pure and Applied Chemistry and its role and activities in scientific and educational applications of chemistry

7.1 The President of the International Union of Pure and Applied Chemistry (IUPAC), Dr Christopher Brett, addressed the SAB on the role of IUPAC in global chemistry, which was highlighted through a presentation of its strategic plan, vision, mission, and core values. The talk was divided into a description of main IUPAC activities on the

world stage and collaboration with the OPCW. Emphasis was given to IUPAC's global role, particularly in the context of a common language of chemistry, the free exchange of chemical data, and fostering sustainable development. This is carried out by a network of volunteers who are scientific experts in different areas of chemistry, from classical areas to others that are cross-discipline and multidisciplinary. IUPAC collaborates with many international organisations to further these aims. The way in which IUPAC's work is carried out through a project system was described; many of the projects lead to recommendations and technical reports that are all open access. Scientific publications from IUPAC-endorsed conferences are published in the scientific journal "Pure and Applied Chemistry", and descriptions of ongoing activities are given in "Chemistry International".³ The OPCW has featured in both these publications. Key current outreach activities that began with IUPAC's centenary in 2019 and continue to date include the periodic table challenge (now in its second edition), the global women's breakfast, and the annual top ten emerging technologies.

- 7.2 The history of collaboration between IUPAC and the OPCW, which began with the OPCW's inception, was illustrated in brief. The extensive cooperation with the OPCW since formal contacts began in 2001 was recognised when IUPAC received the OPCW's The Hague Award in 2019 for fostering the peaceful uses of chemistry and providing the tools and materials for its responsible use. The award is being used by IUPAC to further enhance activities in education and outreach as well as in capacity building in less developed countries. IUPAC has been involved with the preparation of all the OPCW's Review Conferences. A special side event was held during the Fourth Review Conference in 2018, when different aspects of IUPAC's work were illustrated by delegates from IUPAC committees, which has resulted in increased cooperation with the OPCW. OPCW representatives sit on several IUPAC committees, such as the education and green chemistry committees, and are members of project task groups. Symposia are organised at IUPAC-endorsed conferences and IUPAC world chemistry congresses that include OPCW representatives. IUPAC is ready to provide its expertise and knowledge to help in all endeavours linked to the peaceful uses of chemistry and, in particular, to aid in the preparation for the Fifth Review Conference in 2023.
- 7.3 The Board's interest in Dr Brett's presentation and message was high, given the great cooperation between the SAB and IUPAC over the years. They queried him on IUPAC's focus on green chemistry, to which he replied that the IUPAC committee on green chemistry is currently finalising results related to identifying objective metrics that can be applied to determine whether any given process is 'green' or not. He was also asked about whether IUPAC would be able to assist the SAB in some of its important near-term endeavours, such as the recently established TWG on the analysis of biotoxins and the workshop with industry. Dr Brett confirmed that IUPAC remains ready to partner with the SAB on these and other topics of mutual interest and he looks forward to continued discussions to make progress on these ideas.

8. AGENDA ITEM EIGHT – Effects of chemical weapons on human health and countermeasures against them

- 8.1 The opportunity was given to several current SAB members to present their SAB-relevant research. In particular, Dr Zrinka Kovarik shared some of her research

³ More information on IUPAC activities can be found at www.iupac.org.

group's work on nerve agent poisoning and countermeasures. Dr Mostafa Ghanei, whose team's work also focuses on understanding the effects of chemical weapons on human health, also presented some recent findings to the Board.

Subitem 8(a): New insights on countermeasures in nerve agent poisoning

- 8.2 Dr Zrinka Kovarik, Professor at the Institute for Medical Research and Occupational Health, Zagreb, Croatia, presented to the SAB her research results on new insights on countermeasures against nerve agent poisoning. She discussed the chemical properties of organophosphates in the context of their mechanism of toxicity, and how countermeasures can be improved if we know the mechanism of action and the level of their interaction with enzymes. Acetylcholinesterase (AChE)—an enzyme that degrades the neurotransmitter acetylcholine when covalently inhibited by organophosphorus compounds such as nerve agents and pesticides—can be reactivated by oximes. Tabun and soman remain among the most dangerous nerve agents due to the low reactivation efficacy of standard pyridinium aldoxime antidotes. Therefore, finding an optimal reactivator for prophylaxis against their toxicity and for post-exposure treatment is an ongoing challenge.
- 8.3 The high electron density of the phosphoramido group of tabun prevents an efficient nucleophilic attack by oximates.⁴ In addition, the active centre gorge of the tabun-AChE conjugate is sterically congested, thus reducing access of the oxime to the phosphorus centre.⁵ A substantial number of 1,2,3-triazole-linked N-methylpyridinium and 2-methylimidazolium oximes were synthesised using the copper(I)-catalysed azide-alkyne cycloaddition,⁶ and then pharmacologically characterised. About 20 of these new oximes significantly improved in vitro reactivating efficacies for tabun-inhibited AChE when compared to standard pyridinium oximes. In vivo antidotal efficacy for three leads was established in tabun-exposed mice. These findings offer a valuable and comprehensive platform for further development of antidotes and scavengers against exposure to tabun and related phosphoramidates, such as the so-called “novichok” series of compounds.⁷
- 8.4 Exposure to the nerve agent soman is difficult to treat due to the rapid de-alkylation of the soman-AChE conjugate, a phenomenon known as ageing. To overcome this limitation, Dr Kovarik and co-workers tested the capacity of the ageing-resistant human AChE mutant Y337A/F338A in combination with oxime HI-6 to act as a catalytic

⁴ M. Eto in *The Organophosphorus Pesticides* (Ed: G. Zweig), CRC Press Inc., Cleveland, 1976, pp. 142.

⁵ Please see: (a) F. Ekström, C. Akfur, et al. *Biochemistry* 2006, 45, pp. 74–81; (b) F. Ekström, Y. P. Pang, et al. *Biochem. Pharmacol.* 2006, 72, pp. 597–607; (c) E. Artursson, C. Akfur, et al. *Toxicology* 2009, 265, pp. 108–114; and (d) Maja Katalinić, Goran Šinko, et al. Oxime-assisted reactivation of tabun-inhibited acetylcholinesterase analysed by active site mutations. *Toxicology*, 406-407 (2018), pp. 104-113.

⁶ Zrinka Kovarik, Jarosław Kalisiak, et al. Reversal of tabun toxicity, enabled by a triazole annulated oxime library-reativators of acetylcholinesterase. *Chemistry - A European Journal*, 25 (2019), pp. 4100-4114

⁷ Please see: (a) David Steindl, Wolfgang Boehmerle, et al. Novichok nerve agent poisoning. *The Lancet*; published online 22 December 2020: [https://doi.org/10.1016/S0140-6736\(20\)32644-1](https://doi.org/10.1016/S0140-6736(20)32644-1); and (b) Michael Eddleston, Fazle Rabbi Chowdhury. Organophosphorus poisoning: the wet opioid toxidrome. *The Lancet*; published online 22 December 2020: [https://doi.org/10.1016/S0140-6736\(20\)32749-5](https://doi.org/10.1016/S0140-6736(20)32749-5).

bioscavenger of soman.⁸ Soman was hydrolysed shortly after blood was supplemented with the mutant and HI-6, while the oxime-assisted catalytic scavenging of soman in mice improved therapeutic outcomes preventing lethality and delayed onset of toxicity symptoms. This study demonstrated—through a combination of in vitro, in silico, ex vivo, and in vivo tests—a feasible approach to the development of an oxime-assisted catalytic bioscavenger of soman, based on an ageing-resistant human AChE mutant in combination with its efficient reactivator.

- 8.5 The Board had several questions for Dr Kovarik. One was whether computer calculations were used to assist in the development of an appropriate oxime in the case of tabun or soman poisoning. Dr Kovarik confirmed that computational chemistry was utilised to assist in the work, but this is not sufficient on its own; physical experimentation is still needed in this type of work. She added that she was unaware of any efficient oxime that has been synthesised purely as a result of computational science experiments. An additional question was related to the toxicity of nerve agents in the so-called “novichok” family of chemicals. It was posited that recent events have shown that the victims of intoxication could recover with specific and intense treatment.⁹ Dr Kovarik suggested that there could be several reasons for this and, in fact, very little can be found in the literature regarding the toxicological and pharmacokinetic data of these compounds.

Subitem 8(b): National health planning following chemical weapons injuries

- 8.6 Dr Mostafa Ghanei, Director General of the Biotechnology Development Council at the Chemical Injuries Research Center at the Baqiyatallah University of Medical Sciences in Tehran, the Islamic Republic of Iran, shared his findings related to the research on the understanding of the long-term effects of the use of chemical weapons on a population, and the national protocols that need to be developed by affected countries in the aftermath of a chemical weapons attack. He drew on the clinical experiences with the sulphur mustard gas exposure of the Iranian population during the Iraq-Iran war, including the etiology, pathophysiology, and long-term medical impact. He shared the best practices developed in managing chemical injuries, including the infrastructure created to manage associated challenges.
- 8.7 In particular, Dr Ghanei noted that the multi-pronged effects of chemical weapons include their ability to target living organisms while leaving infrastructure undamaged, their indiscriminate nature, and the short- and long-term economic effects that can be debilitating to a city or country. He detailed the effects of chemical weapons use on populations in Iran and their long-term effects on people, which include: post-traumatic stress disorders, the long duration of treatments, the side effects of injuries, the economic pressure of therapeutic costs, the requirement of specific medical conditions, psychological traumas, reduced quality of life, and reduced survival rate due to different acute and chronic complications. Due to the complexity of the injuries and the deficit in repair processes, the severity of such complications increases over time. Following the reduction of the injured patient’s quality of life, the socialisation process and

⁸ Zrinka Kovarik, Nikolina Maček Hrvat, et al. Catalytic soman scavenging by Y337A/F338A acetylcholinesterase mutant assisted with novel site-directed aldoximes. *Chemical Research in Toxicology*, 28 (2015), pp. 1036-1044.

⁹ David Steindl, Wolfgang Boehmerle, et al. Novichok nerve agent poisoning. *The Lancet*; published online 2 December 2020: [https://doi.org/10.1016/S0140-6736\(20\)32644-1](https://doi.org/10.1016/S0140-6736(20)32644-1).

effective communication with society and family are also profoundly affected. Such difficulties further alienate the person from society.

8.8 Dr Ghanei then mentioned some of the ways to alleviate the burdens on people and the government. Increasing health costs and emerging complications can be resolved by specific fundamental accomplishments of governments, including the establishment of specialised commissions to evaluate the status of veterans, covering life and health expenses, establishing specific insurances, granting specific social and economic privileges, as well as founding social and physical rehabilitation facilities. Institutionalising grand-scale research centres and establishing bio-bank and cohort study infrastructures based on centres of excellence provides for the capacities to respond to possible health risks in chemical incidents and threats.

8.9 The floor was opened for questions. One question addressed the possibility of determining whether somebody had been exposed to one type of chemical agent, as opposed to a different agent, based on the presented pathophysiology. Dr Ghanei responded that based on pathophysiology, patients are classified into those exposed to nerve agents and those exposed to blister agents. He underlined that identifying the pathophysiology is very important in determining the type of injury, which is further confirmed by the treatment itself. He clarified that all of his data related to the long-term—but not acute—effects. In response to another question, Dr Ghanei confirmed that, at least based on data that his team has collected from chemical weapons victims in Sardasht city, exposure to chemical weapons did not result in any change in fertility in either males or females. Dr Ghanei was also asked whether he was aware of any scientific literature reporting on the long-term health effects of nerve agent poisoning. Dr Ghanei responded that he was unsure and that his work focuses on Iranian survivors of exposure to chemical weapons, and work continues to understand the long-term effects of exposure in Iranian victims.

9. AGENDA ITEM NINE – Statement on behalf of the OPCW Advisory Board on Education and Outreach

9.1 Dr Craig Cormick and Dr Alastair Hay, members of the ABEO and focal points for cooperation with the SAB, briefed the SAB on ABEO developments since the last SAB session. Dr Hay noted that the ABEO is in its sixth year of operation and is currently chaired by Dr Johannes-Georg Weing of Germany and vice-chaired by Mr Shahab-ud-Din of Pakistan. Dr Hay explained that a new Temporary Working Group on e-Learning has been established under the chairmanship of Professor Rocael Rizzardini of Guatemala, tasked with looking at the Secretariat's current e-learning offerings, what future e-learning opportunities might be, and how this could be achieved. Education about chemical safety, security, and the environment are key interests of the ABEO, as well as how the ABEO can assist in promoting the OPCW Centre for Chemistry and Technology (ChemTech Centre) in the scientific and academic community. Some educational resources on the ABEO website, currently only available in English, are being earmarked for translation into other official OPCW languages. Seven members of the ABEO are retiring at the end of 2021, and Member States are invited to nominate candidates to succeed them.

9.2 Dr Cormick noted that at its last session, the ABEO accepted the Board's new Strategic Plan, which incorporates the priorities outlined by the Director-General. The Plan is being used by the Board to better identify priority audiences and activities.

9.3 The Board sought clarification on the skill sets required for potential nominations to the ABEO. In addition, there was high interest in understanding the progress in the ABEO's current TWG on e-Learning. The SAB Secretary indicated that since the TWG began its activities only recently, the next SAB session may be a reasonable point to ask for an update on the work from the TWG's Chairperson.

10. AGENDA ITEM TEN – Current and future activities of the Scientific Advisory Board

10.1 The SAB Secretary reminded the Board of its near-term objectives and commitments. The SAB devoted a substantial amount of time at its Thirty-First Session to discussing the recently established TWG on the analysis of biotoxins, the Board's preparation for the Fifth Review Conference, and the ongoing planning for a workshop on partnership with industry.

Subitem 10(a): Temporary Working Group on the analysis of biotoxins

10.2 During his opening address at the Thirtieth Session of the SAB, the Director-General announced that he would like to establish a TWG on the analysis of biotoxins, per the terms of reference of the SAB. This decision was made after the SAB made a recommendation in this respect, and after careful consideration of this recommendation and the needs of the Secretariat. As such, the Chairperson of the SAB appointed, with the Director-General's approval, Dr Daan Noort, a current member of the SAB, as Chairperson of this TWG.

10.3 Dr Noort updated the SAB on the progress of the TWG. While the TWG on the analysis of biotoxins has yet to convene its first meeting, establishing the membership has begun. The Director-General has appointed nine members of the SAB (including Dr Noort) to the TWG. In addition, appointment letters were sent to seven external experts to partake as members in the group.

10.4 The terms of reference of the TWG on the analysis of biotoxins were attached as an annex to the appointment letters sent by the Director-General and are also provided in Annex 2 of this report. The terms of reference lay out the reasons for establishing the TWG, and the questions that it should address. The questions focus on the identification of materials of biological origin relevant to the Convention, analysis techniques and procedures, and current and future collaboration with other organisations.

10.5 There were several questions and comments from the Board regarding the TWG. Of particular note was the suggestion that the TWG consider inviting representatives of selected think-tanks, academia, and other expert entities to contribute to its work and research. It was noted that reaching out to the representatives of the Biological Weapons Convention Implementation Support Unit would also be appropriate. The TWG Chairperson and the SAB Secretary noted that it is too early to know the extent of such outreach, but that it is certainly an interesting idea to pursue.

10.6 It is expected that the TWG will be able to initiate its work in April 2021, pending finalisation of the Group's membership and the format of the first meeting, which is to take place virtually due to the ongoing COVID-19 pandemic.

Subitem 10(b): Planning and preparing for the Fifth Review Conference

- 10.7 The SAB Chairs and Secretary led the Board through a discussion on its continued preparation for and work leading up to the Fifth Review Conference. Previously, Board members were split into groups with each team assigned to an overarching topic important to the Board's scientific report for the Fifth Review Conference. Since then, the groups have been collecting relevant studies and information in order to prepare an overview of the important advances and innovations within their respective topics for the report.
- 10.8 While the available time did not allow for each group (of which there are seven) to fully present the status of their work, the floor was open to any groups wishing to update the Board on their approach and work to date. Updates were given by five of the seven assigned groups.
- 10.9 Board members are busy reading the literature and ensuring that the appropriate references and information are being collected and considered. This information is being stored on the SAB SharePoint hub for ease of storage, organisation, and access to all members. It was noted that everyone has an opportunity to glean even more insight into the important topics being covered by suggesting relevant speakers for future SAB sessions and workshops. In addition, the Board started to identify topics that span across groups and is prepared to share information with the entire Board to facilitate a comprehensive and coordinated scientific report.
- 10.10 The Board feels it has a consolidated and organised approach to the Fifth Review Conference. It did, however, ask the SAB Secretary for additional information on the exact timing of the deliverables. The SAB Secretary noted the request and indicated he would provide the Board with a timeline of the work to be performed and a list of milestones. The SAB Chairperson commended the Board on its proactive approach to preparations for the Fifth Review Conference.

Subitem 10(c): Efforts towards a workshop in partnership with industry

- 10.11 Prior to a SAB-led discussion on a future workshop, the SAB was briefed by Mr Szymon Bocheński, Senior Policy Officer in the Office of Strategy and Policy, on the cooperation between the Secretariat and chemical industry associations, in particular the International Council of Chemical Associations (ICCA) and the International Chemical Trade Association (ICTA). The Board was familiarised on practical contributions that chemical industry representatives have been making in support of relevant international cooperation activities conducted by the Secretariat, as well as their engagement in different education and outreach efforts—the development of The Hague Ethical Guidelines in particular. In the context of a planned SAB industry workshop, the Board was informed that in addition to the benefits it would provide to the Board on its provision of scientific advice, it could also be instrumental in creating the opportunity to engage the chemical industry on the scientific aspects of the implementation of the Convention.
- 10.12 Dr Syeda Sultana Razia and Dr Renate Becker-Arnold then updated the SAB on the current status of a workshop with industry. Given the apparent interest and number of mutually interesting topics that can be broached, they noted that the SAB may consider two industry workshops, one in the November 2021 timeframe and the other in late spring of 2022.

- 10.13 The workshops will aim to facilitate an exchange of information on science, technology, and best practices on proposed topics of interest, such as the determination/prediction of hazardous properties of chemicals, phasing out high-risk industrial chemicals, inventory risk assessment, and major hazard control to prevent accidents, as well as decontamination and hazardous waste management.
- 10.14 The identified stakeholders for the workshops are chemical industries from both chemical producing and importing countries, such as ICCA, ICTA, the European Chemical Industry Council, government entities in various States Parties, and technical experts. The European Union Commission and the Organisation for Economic Co-operation and Development may also be invited to share their experience with industry.
- 10.15 The presenters were thanked by the SAB Chairperson for their comprehensive work on this subject, and the floor was opened to questions from the Board. While there are still a few questions related to some of the logistics of the workshops, the Board feels it can continue planning as it resolves any outstanding questions. In particular, it has asked the SAB Secretary to present the SAB's thoughts on a joint workshop with the Chemical Industry Coordination Group at its next meeting later in March 2021. It is hoped that via additional dialogue with industry stakeholders, topics to discuss at the upcoming workshop can be finalised and planning may ensue henceforth.

11. AGENDA ITEM ELEVEN – Any other business

The SAB expressed its appreciation to the Director of the OSP for her welcoming remarks, and to Mr Gorjan Damjanović of the Information Services Branch, Ms Virginie Poujade of the Language Services Branch, Mr Vasily Titushkin of the Secretariat for the Policy-Making Organs, and Ms Ernesa Ademagić of the Office of Strategy and Policy, for their support of and contributions to the SAB's Thirty-First Session and its preparations. A special thanks went to the interpretation teams, who made the meeting possible by allowing everyone to participate. The SAB is grateful for the voluntary contributions made to support its work, as well as the European Union for its April 2019 Council decision, which provides funding for TWGs.

12. AGENDA ITEM TWELVE – Adoption of the report

The SAB considered and agreed upon a process for the preparation of the report for its Thirty-First Session, with a view to adopting it via correspondence after the session.

13. AGENDA ITEM THIRTEEN – Closure of the session

The Chairperson made concluding remarks on the session, and the SAB Secretary closed the virtual session at 16:04 CET on 4 March 2021.

Annexes:

- Annex 1: List of Participants in the Thirty-First Session of the Scientific Advisory Board
- Annex 2 (English only): Terms of Reference of the Temporary Working Group on the analysis of biotoxins

Annex 1

**LIST OF PARTICIPANTS IN THE THIRTY-FIRST SESSION
OF THE SCIENTIFIC ADVISORY BOARD**

	Participant	Institution
Members of the Scientific Advisory Board		
1.	Prof Isel Pascual Alonso	University of Havana, Cuba
2.	Dr Khaldoun Bachari	Algerian Public Scientific and Technical Research Centre in the Physico-Chemical-CRAPC, Algeria
3.	Dr Renate Becker-Arnold	BASF, Germany
4.	Dr Elma Biscotti	Scientific and Technical Research Institute for Defense, Argentina
5.	Dr Anne Bossée	DGA CBRN Défense, France
6.	Dr Christophe Curty (Chairperson)	Spiez Laboratory, Switzerland
7.	Prof Vladimir Dimitrov	Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences, Bulgaria
8.	Dr Mostafa Ghanei, MD	Baqiyatallah University of Medical Sciences, the Islamic Republic of Iran
9.	Mr Wilford Zungkat Jwalshik	Institute of Chartered Chemists of Nigeria, Nigeria
10.	Prof Victor Kholstov	Ministry of Industry and Trade, "GosNIIOKhT", the Russian Federation
11.	Dr Zrinka Kovarik	Institute for Medical Research and Occupational Health, Croatia
12.	Dr Andrea Leisewitz (Vice-Chairperson)	Pontificia Universidad Católica de Chile, Chile
13.	Prof Imee Su Martinez	University of the Philippines-Diliman, the Philippines
14.	Dr Robert Mikulak	United States Department of State, the United States of America
15.	Dr Daan Noort	TNO, Rijswijk, the Netherlands
16.	Prof Ponnadurai Ramasami	University of Mauritius, Mauritius
17.	Mr Günter Povoden	EU CBRN Centres of Excellence Initiative, Ministry of Defence, Austria
18.	Dr Syeda Sultana Razia	Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh
19.	Prof Ahmed E. M. Saeed	Sudan University of Science and Technology, Sudan
20.	Dr Yasuo Seto	RIKEN SPring-8 Center, Japan
21.	Dr Maciej Sliwakowski	Lukasiewicz Research Network – Institute of Industrial Organic Chemistry, Poland
22.	Prof Fengxia Sun	Hebei University of Science and Technology, China
23.	Dr Nomandla Magnificent Vela	Protechnik Laboratories, South Africa
24.	Ms Farhat Waqar	Pakistan Atomic Energy Commission, Islamabad, Pakistan
25.	Mr Szymon Bochenski	Organisation for the Prohibition of Chemical Weapons, the Netherlands

	Participant	Institution
Invited Participants		
26.	Dr Christopher Brett	President of the International Union of Pure and Applied Chemistry, Portugal
27.	Dr Craig Cormick (Member of the ABEO)	Independent Consultant, Australia
28.	Dr Alastair Hay (Member of the ABEO)	University of Leeds, United Kingdom of Great Britain and Northern Ireland
29.	Ms Veronika Stromšíková	Organisation for the Prohibition of Chemical Weapons, the Netherlands
Secretary to the Scientific Advisory Board		
30.	Dr Peter Hotchkiss	Organisation for the Prohibition of Chemical Weapons, the Netherlands

Annex 2

TERMS OF REFERENCE FOR THE TEMPORARY WORKING GROUP ON THE ANALYSIS OF BIOTOXINS

1. The use of biological toxins as weapons is prohibited both under the Chemical Weapons Convention (CWC) and the Biological and Toxin Weapons Convention (BTWC). In the past, several biological toxins were weaponised, leading to the inclusion of both saxitoxin and ricin in Schedule I of the Annex on Chemicals to the CWC. Further, there are some biological toxins that are of interest to non-state actors. Accordingly, the capability to detect, identify, and characterize biological toxins that may be present in samples taken during investigations is essential for the OPCW. Internationally, there are other stakeholders with a mandate related to biotoxins; the UN Secretary-General's Mechanism for Investigating Alleged Use of Chemical and Biological Weapons (UNSGM) also provides guidance and assistance related to misuse of biotoxins. As such, it is also imperative that the OPCW and the UNSGM work cohesively to share information and minimize duplication of effort, since either might be called on to conduct an investigation of alleged use of a biological toxin.
2. An in-depth review of the methods and technologies used in the analysis of biotoxins would be useful and would be relevant to and augment the capacity of the Technical Secretariat. Further to his response to the report of the Twenty-Ninth Session of the SAB (SAB-29/1, dated 2 September 2020) and in accordance with paragraph 9 of the terms of reference of the SAB (Annex to C-II/DEC.10/Rev.1, dated 2 December 2004), the Director-General has therefore decided to establish a Temporary Working Group (TWG) on the Analysis of Biotoxins and has appointed Dr Daan Noort as the Chairperson of the Group.
3. The objective of the TWG is to review the science and technology relevant to the analysis of biotoxins and considerations that need to be taken into account in investigations of their alleged use. Considerations should be given to the work and recommendations from the SAB's previous TWG on Investigative Science and Technology (SAB/REP/1/19, dated 1 December 2019). The work of this TWG is intended to identify capabilities, skill sets, and equipment that would augment and strengthen the Technical Secretariat's capabilities. The findings will be considered by the SAB and recommendations will be provided to the Director-General.
4. The TWG will consist of individuals who have expertise in the theory and practice of biotoxin analysis, including but not limited to laboratory techniques, low and high molecular weight biotoxins, investigational analysis, evidence collection, forensic sciences, informatics, toxicology, or experience of implementation of the Chemical Weapons Convention. The TWG will be comprised of qualified members of the SAB as well as representatives from relevant scientific and international organisations. Guest speakers will be invited regularly to assist the TWG in its collection of data and information and the formulation of advice. The TWG may also, when necessary, draw upon the expertise of the Technical Secretariat, in particular the OPCW Laboratory, Inspectorate, non-routine missions and the Assistance and Protection Branch.

5. The TWG will report to the SAB, and will consider the following questions, in particular:
- (a) What are the underlying requirements for the analysis of biological toxins in order to investigate alleged use of toxic chemicals as weapons?
 - (b) What classes of biological toxins are most likely to be relevant in investigations of alleged use?
 - (c) Are there other relevant compounds of biological origin that should also be considered based on their potential for misuse or technological change associated with them?
 - (d) What are the technical requirements for analysis of the most relevant types of biological toxins? Please consider:
 - (i) analytical approaches needed for unambiguous identification of both low and high molecular weight biotoxins;
 - (ii) instrumentation and/or procedures that should be standardized across labs to ensure reproducible and consensus results;
 - (iii) analytical criteria that should be in place in order to match forensic requirements;
 - (iv) the role and utility of degradation products and other markers and/or compounds; and
 - (v) the role of biomarkers and biomedical samples.
 - (e) What are the analytical standards and requirements of other international and national investigative authorities and how do these compare and/or factor into OPCW considerations and operations?
 - (f) How can programs of analytical exercises conducted by different networks of laboratories be coordinated or harmonized to minimize duplication, promote consistent practices, and develop a comprehensive picture of laboratory capabilities? Please consider:
 - (i) the quality system requirements for the laboratories that should be in place (e.g., consideration of ISO 17025 for OPCW Designated Labs); and
 - (ii) how the analytical exercises can be harmonized yet remain flexible to address new or emerging biotoxin threats.
 - (g) What institutional or legal measures need to be established to facilitate cooperation between the OPCW and other organizations working on development of capabilities for analysis of biological toxins?

6. In addition, the TWG will provide advice, as requested, on Technical Secretariat proposals for methodologies, procedures, technologies, and equipment for the analysis of biotoxins.
7. The Director-General might pose other relevant questions to the TWG, through the SAB.
8. The TWG will exist for a period of two years from the date of this memo (26 January 2021). 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 these terms of reference should be revised.

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