

**REPORT OF THE SCIENTIFIC ADVISORY BOARD  
AT ITS THIRTY-FIFTH SESSION****1. AGENDA ITEM ONE – Opening of the session**

1.1 The Scientific Advisory Board (SAB) met for its Thirty-Fifth Session from 13 to 16 June 2022. The session was chaired by Mr Günter Povoden, with Dr Andrea Leisewitz serving as Vice-Chairperson.

1.2 Mr Povoden opened the Thirty-Fifth Session of the SAB by welcoming SAB members to the first in-person session in three years. He indicated his excitement for the session and reiterated that the Board had a lot of work ahead, including its work to finalise its Report on Developments in Science and Technology for the upcoming Fifth Review Conference (hereinafter “Scientific Report”).<sup>1</sup> The SAB Chairperson also welcomed the invited speakers and noted that he was looking forward to their presentations and the discussions that followed.

**Executive summary**

1.3 The Board was able to meet in person at OPCW Headquarters for the first time in three years. However, while travel was possible, there were still a number of restrictions and disruptions due to the COVID-19 pandemic, which did not allow all SAB members to attend the session.

1.4 The session mainly focused on internal SAB business, such as continued discussions on its Scientific Report in support of the Fifth Review Conference, continued consideration of central nervous system-acting chemicals (CNS-acting chemicals), potential scientific activities for the Centre for Chemistry and Technology (ChemTech Centre), and upcoming SAB events and activities. The SAB also heard from a number of Technical Secretariat (hereinafter “the Secretariat”) staff members, and received updates from the SAB Secretary, the Secretary to the Advisory Board on Education and Outreach (ABEO), the OPCW Laboratory, and the Head of the Assistance and Protection Branch. In addition, the Board heard from several external speakers on topics including standards-free approaches for identifying unknown chemicals, approaches to supporting the non-proliferation of chemical weapons, and the importance of scientific advice. Lastly, the Board’s own Professor Elisa Orth gave a presentation on her research group’s efforts on neutralisation and detection of organophosphates.

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<sup>1</sup> The Fifth Conference of the States Parties to Review the Operation of the Chemical Weapons Convention.



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

The SAB adopted the following agenda for its Thirty-Fifth Session:<sup>2</sup>

1. Opening of the session
2. Adoption of the agenda
3. *Tour de table*
4. Establishment of a drafting committee
5. Welcome address by H.E. Fernando Arias
6. Update on the activities of the Technical Secretariat and the Scientific Advisory Board
7. Tales from the chemical universe: Blurred boundaries and list-less challenges
8. Neutralisation and detection of organophosphates: versatile, fast, selective, and sustainable
9. Supporting chemical weapons non-proliferation by expanding the Chemical Weapons Convention Schedules and leveraging cheminformatics solutions
10. Updates and discussion on the Board's Scientific Report for the Fifth Review Conference
11. Responding to advances in science and technology: challenges and opportunities
12. Continued brainstorm session on the Centre for Chemistry and Technology
13. Updates on the work of the Advisory Board on Education and Outreach
14. Updates on the OPCW's Assistance and Protection Branch
15. Discussion on central nervous system-acting chemicals
16. Upcoming Scientific Advisory Board events and work
17. Update on OPCW proficiency testing
18. Any other business and final remarks
19. Adoption of the report
20. Closure of the session

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It should be noted that not all agenda items were covered sequentially during the session due to last-minute time conflicts.

**3. AGENDA ITEM THREE – *Tour de table***

As this was the first in-person meeting the Board had convened in three years, and given that 13 new Board members had joined in that time frame, the Chairperson invited all Board members to briefly introduce themselves.

**4. AGENDA ITEM FOUR – Establishment of a drafting committee**

The Chairperson asked volunteers who wished to be part of the drafting committee to notify the SAB Chairperson, Vice-Chairperson, or Secretary, accordingly. It was agreed, given that some Board members were unable to travel to the session, that the report would be finalised via correspondence after the session ended.

**5. AGENDA ITEM FIVE – Welcome address by H.E. Fernando Arias**

5.1 The Director-General of the OPCW Secretariat, H.E. Fernando Arias, welcomed everyone to the Thirty-Fifth Session of the Board. He noted the welcome change in being able to meet in person again after the long break imposed by the pandemic. He thanked the Board members for their continued work and dedication throughout the pandemic, and for their travel to this session, noting that while restrictions have been relaxed, travel is still not back to normal. He added that he considers in-person meetings to be crucial to the Board's work, as they promote collegiality and allow the Board to deliberate important topics much more candidly.

5.2 The Director-General reported on the progress made in the construction of the ChemTech Centre, which will significantly support the mission and work of the Organisation. He acknowledged the work that the Board has done in identifying some possible scientific activities that could take place at the ChemTech Centre and looked forward to these suggestions.

5.3 The Director-General then highlighted the decision that States Parties adopted at the Twenty-Sixth Conference of the States Parties (hereinafter "the Conference") entitled "Understanding Regarding the Aerosolised Use of Central Nervous System-Acting Chemicals for Law Enforcement Purposes" (C-26/DEC.10, dated 1 December 2021). He reiterated that the SAB's advice throughout the years has been valuable in relation to this topic. The Director-General indicated his interest in the Board's updated thoughts on this topic after its scheduled discussion during the session.

5.4 Recalling that the upcoming Fifth Review Conference will take place in May 2023, the Director-General reiterated the importance of the Board's Scientific Report in support of the Conference. He recognised the Board's ongoing endeavours to aggregate the necessary information, noting the topical workshops they planned on holding directly after the conclusion of the SAB session, such that they can produce a comprehensive and impactful report.

5.5 In conclusion, the Director-General thanked the Board members for their dedication and wished them a productive session.

**6. AGENDA ITEM SIX – Update on the activities of the Technical Secretariat and the Scientific Advisory Board**

- 6.1 The SAB Secretary briefed the Board on relevant and recent developments at the OPCW, as well as current topics for SAB consideration. He noted the ongoing work of the Board in preparing its Scientific Report for the Fifth Review Conference. In that vein, he provided overviews of the two topical workshops the SAB would be holding immediately after the conclusion of the current meeting. These workshops will assist the Board in understanding the latest developments in those areas.
- 6.2 The first workshop, to be held immediately following the SAB session, is co-facilitated in partnership with the International Union of Pure and Applied Chemistry (IUPAC), a long-standing partner of the OPCW and the SAB. The focus of the workshop will be on artificial intelligence-assisted chemistry. He reminded the Board that the workshop is a culmination of the Board's hard work, in particular Prof Ahmed Saeed, who put a lot of energy into identifying topics and presenters. The SAB Secretary shared the agenda of the workshop and remarked on the strong presence of the Board at the workshop, which will ensure lively discussion following the presentations.
- 6.3 The other topical workshop, held in partnership with chemical industry representatives, is focused on emerging scientific trends and directions in the chemical industry. Dr Renate Becker-Arnold and Prof Syeda Sultana Razia worked tirelessly to ensure the workshop could successfully take place. The workshop is scheduled for the week following this session, on 20 and 21 June 2022, and will be held at the BASF production facility in Antwerp. It will feature a number of industry speakers with SAB members and Secretariat staff in attendance.
- 6.4 Lastly, the SAB Secretary provided an update on the OPCW Plant Biomarkers Challenge, sharing the various approaches each of the six teams are taking in regard to understanding the different means by which plants can be used as sentinels of toxic chemical exposure.

**7. AGENDA ITEM SEVEN – Tales from the chemical universe: Blurred boundaries and list-less challenges**

- 7.1 In the control of chemicals within regulatory and oversight frameworks, and especially for chemical security purposes, a typical practice is to define a list of chemicals of security concern that can then be monitored and controlled as part of implementation. This is exemplified by the Schedules of the Chemical Weapons Convention (hereinafter "the Convention"). However, implementation based on lists is fraught with complications due to how chemicals are defined (which can be as broad and potentially open-ended families of substances), the reality that there are an infinite number of possible chemicals that can exist, the fact that all chemicals have concentration-dependent hazards (even those that are benign), and that no list can ever be comprehensive or complete if the objective is to recognise all potential chemical threat agents. Furthermore, the widespread availability of starting materials for millions of highly toxic compounds and instructional materials outlining how to produce them have reduced barriers to entry for the nefarious use of chemicals. Against this backdrop, while the steady progress towards the elimination of declared chemical weapons stockpiles has also driven the deployment of capabilities to detect and respond to

a broad range of classes of chemicals with known potential to be used as weapons, the norms against weaponising chemicals subject to control under the Convention are nevertheless challenged through the continued use of chemicals that may not be listed in the Schedules as weapons, and deploying chemicals in ways that were not envisioned at the time of treaty negotiation.

- 7.2 These challenges include the weaponisation of types and classes of chemicals broader than covered by the Schedules. These chemicals could be obtained from readily available sources and/or combined with low-tech approaches to both making and dispersing chemical threat agents. Proliferators have diverse options to deploy chemicals as weapons, combined with anonymity and the speed at which chemical structures that fall outside established regulatory control listings and control oversight measures can now be produced. This new reality exposes an urgent need for domestic and international decision makers to have access to technical tools and approaches that fundamentally change how they think about, respond to, and mitigate the effects of weaponised chemicals in order to effectively counter the ever-changing chemical threat landscape. Success requires enhanced capabilities and threat-agnostic approaches in order to generate answers at the speed of relevance for decision making. Innovative and enabling approaches are being realised by blending advanced statistics, machine learning, computational chemistry, measurements expertise, and increased exploitation of observable and presumptive signatures of chemical threat agent presence and exposure. To ensure that approaches are actionable, decision makers need to be able to synthesise the information gleaned from these methods to establish functional threat awareness and surveillance.
- 7.3 In his talk, Dr Jonathan Forman (Pacific Northwest National Laboratory) discussed the general challenges of being faced with a universe of chemicals and how observable signatures and standards-free approaches might be used to overcome this adversity. The most technical parts of the talk focused on developing methods to identify unknown chemicals from mass spectra that take inspiration from methods developed for metabolomics. A key enabler in these efforts is the use of computational chemistry and machine learning to predict spectra and/or chemical properties. Dr Forman concluded with thoughts and perspectives on what is required to adopt standards-free approaches, and how they might be expanded beyond mass spectrometry and familiar types and classes of chemicals.
- 7.4 Following Dr Forman's presentation, there was a robust discussion on the need to evolve from reactive approaches to threats and risk, to proactive approaches, noting that future threats and needs to counter threats and risks may be non-traditional in nature. Another talking point addressed the potential for including a declaration of multi-use potential or concern when submitting manuscripts for publication in scientific journals. There are currently declarations for other aspects, such as funding sources and author contributions.
- 8. AGENDA ITEM EIGHT – Neutralisation and detection of organophosphates: versatile, fast, selective, and sustainable**
- 8.1 Prof Elisa Orth (Universidade Federal Do Paraná) gave a presentation to the Board on her research group's work in the neutralisation and detection of organophosphates. Organophosphates are a class of compounds that garner attention due to their relative toxicity, which underpins their widespread use historically as nerve agents; they are

also still used in many pesticide formulations. There has been great interest, therefore, in developing efficient methods that could either monitor the misuse of these compounds or provide appropriate neutralisation of unwanted stockpiles.

- 8.2 Dr Orth's group has focused on three different areas of research associated with organophosphates: milder conditions for synthetic and neutralisation processes; catalysts-by-design derived from nanomaterials and sustainable sources (e.g., rice husks and shrimp shells); and portable and colorimetric detectors. With regard to the first area, they have shown the ability to efficiently neutralise several pesticides (> 5) and a Tabun simulant with over 30 different types of catalysts (homogeneous and heterogeneous).<sup>3</sup> Mechanistic studies and structure–reactivity relationships have shown to be valuable tools for predicting reaction outcomes and modulating towards less toxic products.
- 8.3 On-demand functionalisation has also been pursued on various scaffolds under mild conditions (aqueous, neutral pH, ambient conditions) using different anchoring groups, such as imidazoles, hydroxamates, amidoximes, and thiols, in order to produce effective catalysts. The catalysts can act as neutralising agents for organophosphates, accelerating a process that in some cases could take millions of years to less than one day. The process guarantees fewer toxic products, is selective, and is recyclable. The group has also tested easy handling and separation of organophosphates via magnetic and thin film modalities.<sup>4</sup>
- 8.4 Dr Orth's group also investigated different types of substrates to anchor their catalysts. Research into bioinspired, bifunctionalised nanocatalysts derived from graphene oxide indicated that higher functionalisation of the graphene oxide did not actually produce the best catalysts.<sup>5</sup> They attribute this to neighbouring effects, such as steric hindrance or nonideal positioning of the reactive chemical moieties. Some nanocatalysts have also been used as sensors based on surface-enhanced Raman spectroscopy and electrochemical responses. The group has developed a neutralising gel derived from functionalised carboxymethylcellulose, which is promising for the prevention of cutaneous intoxication, and even successfully functionalised rice husks with amidoxime.<sup>6</sup>

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<sup>3</sup> (a) Nucleophilic Neutralization of Organophosphates: Lack of Selectivity or Plenty of Versatility? V. B. Silva, R. B. Campos, P. Pavez, M. Medeiros, E. S. Orth; *Chem. Rec.* 2021, 21(10), 2638-2665. DOI: <https://doi.org/10.1002/tcr.202100123>; (b) Competitive Reactivity of Tautomers in the Degradation of Organophosphates by Imidazole Derivatives. R. B. Campos, V. B. Silva, L. R. A. Menezes, F. M. M. Ocampos, J. M. Fernandes, A. Barison, A. R. M. Oliveira, D. J. Tantillo, E. S. Orth. *Chem. Eur. J.* 2020 26(22), 5017-5026. DOI: <https://doi.org/10.1002/chem.201905379>; (c) Puzzling Reaction of Imidazole with Methyl Parathion: P=S versus P=O Mechanistic Shift Dilemma in Organophosphates. V. B. Silva, L. L. Q. Nascimento, M. C. Nunes, R. B. Campos, A. R. M. Oliveira, E. S. Orth. *Chem. Eur. J.* 2019 25(3), 817-822. DOI: <https://doi.org/10.1002/chem.201804107>; and (d) Are Imidazoles Versatile or Promiscuous in Reactions with Organophosphates? Insights from the Case of Parathion. V. B. Silva, E. S. Orth. *J. Braz. Chem. Soc.*; 2019, 30(10). DOI: <https://doi.org/10.21577/0103-5053.20190084>.

<sup>4</sup> Imidazole-derived graphene nanocatalysts for organophosphate destruction: Powder and thin film heterogeneous reactions. L. Hostert, S. F. Blaskiewicz, J. E. S. Fonsaca, S. H. Domingues, A. J. G. Zarbin, E. S. Orth. *J. Catal.* 2017, 356, 75-84. DOI: <https://doi.org/10.1016/j.jcat.2017.10.008>.

<sup>5</sup> Neighboring Effects on the Selective Bifunctionalization of Graphene Oxide for Nanocatalytic Organophosphate Neutralization. Y. H. Santos, A. H. G. Martinez, A. G. Veiga, M. L. M. Rocco, A. J. G. Zarbin, E. S. Orth. *ACS Appl. Nano Mater.* 2022, 5(5), 6001–6012. DOI: <https://doi.org/10.1021/acsanm.2c00832>.

<sup>6</sup> Waste-derived biocatalysts for pesticide degradation. J. G. L. Ferreira, W. H. Takarada, E. S. Orth. *J. Haz. Mat.*; 2022, 427, 127885. DOI: <https://doi.org/10.1016/j.jhazmat.2021.127885>.

- 8.5 Finally, portable detectors based on a colorimetric signal triggered from a reaction (neutralisation or derivatisation) have been developed to detect the presence of organophosphate-based pesticides.<sup>7</sup> These detectors have been made on both paper and glass substrates and have been successfully validated using some common agrochemicals (parathion, paraoxon, glyphosate, and acephate). Prof Orth ended her talk by noting that although versatility is sometimes unwanted, her group uses it strategically in different ways, all with the aim of helping to detect or neutralise toxic organophosphates.
- 8.6 When asked what motivates her research, Prof Orth noted that Brazil is one of the world's largest consumers of pesticides and that developing an inexpensive, accurate sensor for these pesticides is very important for monitoring their use and reducing their overuse and misuse. She also noted that while the transparent-to-yellow colour change (due to the derived nitrophenol compounds) used by the sensor developed by the group is not the most striking to the naked eye, camera sensors and other imaging techniques can easily sense substantive colour changes that the human eye cannot.

**9. AGENDA ITEM NINE – Supporting chemical weapons non-proliferation by expanding the Chemical Weapons Convention Schedules and leveraging cheminformatics solutions**

- 9.1 The Annex on Chemicals to the Convention was recently amended to include four new entries in Schedule 1. Three of these entries correspond to organophosphorus nerve agents associated with the so-called novichok family of chemicals. Prof Stefano Costanzi (American University) first presented on the factors that led to this amendment and indicated additional compounds that could be considered in future amendments to the Annex on Chemicals.<sup>8</sup>
- 9.2 Specifically, Prof Costanzi proposed considering the addition of the families of both phosphonates and phosphates with guanidine branches to the Annex on Chemicals to the Convention. He noted that while both phosphonates and phosphates with amidine moieties were added in 2019,<sup>9</sup> only a single guanidine phosphonate compound was added as an individual entry. Yet there are other known organophosphorus compounds with guanidine branches that are currently unscheduled. Additionally, he noted the absence of any precursors of the new entries 1A.13, 1A.14, and 1A.15 scheduled in Part B of the Annex on Chemicals. He therefore also advocates for appropriately scheduling the associated precursor families, as is currently done for the more traditional organophosphorus nerve agents.
- 9.3 Another focus of the Costanzi Group is on developing cheminformatics tools. Prof Costanzi discussed the challenges that frontline officers have when enforcing different rules and regulations based on lists of chemicals such as the Annex on Chemicals. He highlighted two main problems: first, that families of chemicals are not easy to interpret, especially for non-chemists; and second, that synonyms and chemical

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<sup>7</sup> Colorimetric detection of glyphosate: towards a handmade and portable analyzer. R. Hellinger, V. B. Silva, E. S. Orth. *Pure Appl. Chem.* 2020, 92(4), 601-616. DOI: <https://doi.org/10.1515/pac-2019-0818>.

<sup>8</sup> Strengthening controls on Novichoks: a family-based approach to covering A-series agents and precursors under the chemical-weapons nonproliferation regime. S. Costanzi, G. D. Koblenz. *The Nonproliferation Review.* 2022. DOI: <https://doi.org/10.1080/10736700.2021.2020010>.

<sup>9</sup> Note by the Technical Secretariat: Consolidated Text of Adopted Changes to Schedule 1 of the Annex on Chemicals to the Chemical Weapons Convention (S/1820/2019, dated 23 December 2019).

variants complicate the issue of checking control lists through names and the Chemical Abstracts Service (CAS) Registry Numbers<sup>®</sup>. His research group, in collaboration with the Stimson Center and with funding from Global Affairs Canada, is currently involved in developing a prototype software tool that will help frontline officers to both identify chemicals and understand whether they appear on any specific control list that would prompt further consideration or investigation.<sup>10</sup>

- 9.4 There was a good discussion between Prof Costanzi and the Board on whether additional chemicals should in fact be added to the Annex on Chemicals, and how many—i.e., how large should the chemical families be. It was noted that including alkyl chains up to ten carbons in length in the families of the newly scheduled chemicals may be too much. The number of chemical compounds to be handled by OPCW designated laboratories would increase dramatically with all difficulties related to the purpose of verification. Prof Costanzi did mention that while they are not scheduled under the Convention, a number of precursors of the newly scheduled chemicals are listed in the common control list of the Australia Group.<sup>11</sup>
- 9.5 The Board indicated that it thought the software tool that the Costanzi Group is involved in developing will be a valuable tool and looked forward to hearing more about it as it matures. Prof Costanzi was also asked whether it would make sense to have unique quick response (QR) codes on the bottles of each type of chemical or chemical mixture—much like chemicals each have individual CAS numbers. This would also be a quick way for frontline officers to be able to call up critical information about the chemical(s). He indicated that this is in fact being considered in China, where they see value in adding QR codes to chemical bottles to assist operators. He noted it would be useful in industrial and academic laboratory settings as well, where it could greatly assist in keeping up-to-date inventories.

## **10. AGENDA ITEM TEN – Updates and discussion on the Board’s Scientific Report for the Fifth Review Conference**

- 10.1 The SAB Secretary provided an overview of the content and schedule of preparations for the Board’s Scientific Report for the Fifth Review Conference and reminded the Board of the subgroups and their topical areas of focus. He also reiterated the changes in the subgroup compositions as of 2022, given the six new Board members. With the Fifth Review Conference scheduled for May 2023, the SAB’s Scientific Report should be finalised by November 2022.
- 10.2 Subgroups were then given time to work independently to refine their approach and text. Subgroup leads then presented their progress in detail to the Board. For each subgroup readout there was abundant discussion, and the Board was able to provide constructive comments that will strengthen the various subgroup texts. The SAB Chairperson and Vice-Chairperson then suggested that the subgroups attempt to submit first drafts of their respective texts, copying the SAB Secretary, by 31 July 2022. This will provide time in August to deliver feedback such that the subgroups have time to revise their texts before the Board convenes again at the Thirty-Sixth Session of the SAB at the end of September.

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<sup>10</sup> See: <https://www.stimson.org/2022/the-nonproliferation-compliance-cheminformatics-tool-ncct-moves-to-field-testing/>.

<sup>11</sup> See: <https://www.dfat.gov.au/publications/minisite/theaustraliagroupnet/site/en/precursors.html>.



**11. AGENDA ITEM ELEVEN – Responding to advances in science and technology: challenges and opportunities**

- 11.1 Dr Ralf Trapp (Independent Consultant) provided the Board with an overview of the history of the SAB, highlighting the importance of the SAB and its scientific advice to the Secretariat and the Convention.
- 11.2 Scientific advice is essential for the implementation of the Convention, as it was during the negotiations of the Convention itself. Political and legal decisions by the OPCW's policy-making organs must be anchored in a good understanding of the underlying sciences, a strong evidential base, and confidence in the methods and systems used for implementing the Convention. Scientific advice can take several forms, including:
- (a) advice on specific implementation issues. One past example centres on the question of what constitutes ricin, and how the different provisions of the Convention should be applied to activities involving materials containing this Schedule 1 chemical;
  - (b) broadband screening or monitoring, and evaluation of advances made in science and technology, as these may affect the scope and implementation of the Convention. The SAB is currently seized with doing just this as it prepares its Scientific Report in support of the Fifth Review Conference;
  - (c) in-depth analyses of issue areas of particular relevance to the OPCW. The Board has often tackled this via temporary workings groups (TWGs) and has focused on topics such as verification or investigative sciences, among many others; and
  - (d) specific issues passed to the SAB by the Director-General, or where the SAB's advice is requested through decisions taken by the policy-making organs or pursuant to certain provisions of the Convention, such as the inclusion of additional chemicals in the Schedules in the Annex on Chemicals or the recent Conference decision related to aerosolised CNS-acting chemicals.
- 11.3 Scientific advice must be based on sound science and realistic assessments of what new technologies can offer. It should also take into account the broader context, including the changing risk landscape related to toxic chemicals and chemical warfare, economic factors, and policy and legal constraints. It should recognise the needs and expectations of policy makers and implementers.
- 11.4 Advances in science and technology have the potential to be misused, but at the same time, these advances can be utilised to strengthen protections and defences against chemical weapons. Scientific advice, therefore, should look at challenges as well as opportunities emanating from advances in science and technology with a view to supporting the Convention. Some examples include the increasing application of artificial intelligence in the chemical sciences, automation of synthesis and cloud manufacturing, and scientific convergence.
- 11.5 From time to time, scientific advice should return to the basic question of how the Convention is functioning in an ever-changing implementation environment. Are the procedures and methods established to meet the objectives of the treaty still relevant today? Are the implementation systems of the Convention still fit for purpose?

- 11.6 Scientific advice should be anchored in the global scientific community, while also feeding back into this community to help create a deepening awareness of Convention-related issues and develop a professional culture of responsibility, including with regard to the norms applicable to chemical weapons.
- 11.7 Scientific advice should be understood to be a communication across different communities, such as those based on diplomacy, policy, law, science and technology, and industry. To be effective, care must be taken to appreciate the differences in the culture, language, methods, and expectations of these different communities. Scientific advice is essential for good policy making, but it is always only one aspect of that process.
- 11.8 Given Dr Trapp's long history in arms control and disarmament matters, and his previous work with and at the OPCW, there was a long discussion after his presentation on all aspects related to the SAB and scientific advice.

**12. AGENDA ITEM TWELVE – Continued brainstorm session on the Centre for Chemistry and Technology**

The Board continued its discussion on scientific activities it feels would be appropriate to host at the ChemTech Centre. These ideas will continue to be refined and then communicated to the Director-General.

**13. AGENDA ITEM THIRTEEN – Updates on the work of the Advisory Board on Education and Outreach**

- 13.1 The Secretary of the ABEO, Ms Luisa Sánchez-Bravo, provided an update on ABEO activities. She focused on the Board's priority areas of work, such as its contribution to the development of a set of online learning modules for universities to raise awareness of the OPCW and its mission. She added that the Secretariat is in the process of looking for a qualified producer of the modules and, in parallel, identifying a platform provider for a new Learning Management System. The aim is to have the platform available and modules ready by the first half of 2023. The implementation of both projects is possible thanks to funding from the European Union. Much of the Board's advice in this area was conceived via a recent TWG on e-learning. Ms Sánchez-Bravo further provided an update on the translation and dissemination of education and outreach resources, also funded by the European Union. She concluded with a summary of the ABEO's upcoming work, which will include addressing the Open-Ended Working Group (OEWG) on the Preparations for the Fifth Review Conference this autumn.
- 13.2 The SAB members asked a number of questions related to the e-learning modules in development, including the ABEO's involvement with the modules and what kind of supplemental materials will accompany them. The ABEO Secretary noted that the ABEO will perform peer review of the content provided to the producer by the Secretariat. Moreover, the ABEO will design a dissemination plan and provide advice on how to best integrate this set of modules into the university curricula in different regions. Guidance will also be provided with the modules to ensure that educators can properly utilise them in their courses.

13.3 The Board emphasised its support of this e-learning effort and the broader work of the ABEO, while recognising the importance of education and outreach within the broader mission of the OPCW. The Board indicated its willingness to provide support wherever possible, whether that be in content creation or review, or the promotion and dissemination of developed materials.

**14. AGENDA ITEM FOURTEEN – Updates on the OPCW’s Assistance and Protection Branch**

14.1 The Head of the OPCW’s Assistance and Protection Branch, Mr Gareth Williams, presented an update on the Branch’s activities. He reminded the Board of the mandate set out in Article X of the Convention, and the overarching objectives of the Assistance and Protection Branch in that regard. One of the Branch’s ongoing projects is maintaining the Protection and Assistance Databank (PAD). The PAD is a databank that contains entries of means of protection against the chemical weapons declared by States Parties. Another of the Branch’s ongoing tasks is managing and responding to offers of assistance.

14.2 Mr Williams concluded by noting some of the other current initiatives of the branch, including the development of an online self-assessment tool, the expansion of multi-component exercises, as well as chemical emergency response and coordination across African States, among other projects. He also noted the Branch’s incorporation of e-learning approaches to augment in-person training, and how this will likely be a useful approach for capacity-building efforts moving forward.

14.3 The Board asked whether consideration had been given as to how the ChemTech Centre will feature in the Assistance and Protection Branch’s future programming. Mr Williams responded that normal regional events will still be conducted “locally” within each region, but that it would make sense for culmination events, like training-for-trainers events, to bring participants from around the world to a central location, such as the ChemTech Centre, where experiences and best practices could be shared. This approach is being explored and may potentially be incorporated starting next year.

14.4 The Board also noted the increased use of augmented and virtual reality (AR/VR) platforms providing virtual and remote capacity building, and wondered whether these tools are being incorporated in any of the Assistance and Protection Branch’s activities. Mr Williams replied that yes, certain AR and VR applications are being more heavily used, especially in medical arenas, and the Branch is looking into how they can be utilised in future training events.

**15. AGENDA ITEM FIFTEEN – Discussion on central nervous system-acting chemicals**

The SAB continued its consideration of CNS-acting chemicals, with the aim of ensuring that it provides updated advice on this topic in its Scientific Report in support of the Fifth Review Conference.

**16. AGENDA ITEM SIXTEEN – Upcoming Scientific Advisory Board events and work**

The Board used this time to continue its discussion on how it wants to handle SAB-authored publications moving forward. Dr Forman served as the previous Secretary to the SAB and was able to provide an overview of how publications were handled in the past. He noted that the SAB has a rich history of publishing scientific literature and that at least occasional formal publishing of its work and advice not only helps ensure that the Board's advice reaches a wider audience, but it also demonstrates the scientific merit of the work of the SAB through the independent peer review associated with the publication process and highlights the diverse, collective nature of the SAB and the OPCW. The Board welcomed Dr Forman's extensive summary of past practices and agreed that continuing the approach as conveyed was reasonable. It was also suggested that a set of guidelines be developed to assist Board members now and in the future on how to best identify and determine opportunities to publish peer-reviewed scientific literature.

**17. AGENDA ITEM SEVENTEEN – Update on OPCW proficiency testing**

- 17.1 Mr Alexandre Bennett, Senior Analytical Chemist in the OPCW Laboratory, provided the Board with an update on ongoing proficiency testing that the Laboratory administers and oversees. He gave a brief overview of the current laboratory facility and its accreditation before providing more details about the three different types of proficiency testing and exercise activities it operates: two ISO 17043 accredited proficiency testing schemes (environmental and biomedical), the Convention Chemical Analysis Competency Test (CCACT), and the biotoxin sample analysis exercise.
- 17.2 Environmental proficiency tests are the longest running test the OPCW administers, the programme having been formalised about 25 years ago. These types of tests focus on environmental samples, which may include neat chemical weapon agent, residue from a reaction or container, or for example, from contaminated clothing, hair, soil, and water. More recently, a biomedical proficiency test was established in 2016 after six years of preliminary exercises. Biomedical samples include urine, blood, plasma, and tissue, among others, and often do not contain an intact analyte of interest, but often contain an associated biomarker, metabolite, or degradation or reaction product instead.
- 17.3 Laboratories from OPCW Member States can participate in these proficiency tests and earn a status of OPCW designated laboratory if they meet certain testing and reporting criteria. There are currently 24 designated laboratories for environmental samples and 20 designated laboratories for biomedical samples. Mr Bennett noted the likely inclusion of newly scheduled chemicals into future proficiency tests.
- 17.4 Mr Bennett then turned to the CCACT. Fourteen CCACTs have been held since 2015. These tests are closely related to environmental proficiency tests and are designed to support the development of aspiring laboratories in chemical weapons-related analysis, often with the goal of qualifying as a designated laboratory. Mr Bennett then turned to the ongoing biotoxin sample analysis exercise, and noted that they are currently in the evaluation phase of the sixth exercise. He noted the continued level of interest in this exercise and indicated that there is potential to transition this exercise into a fully-fledged proficiency test in the future.

- 17.5 Lastly, Mr Bennett turned to some ongoing considerations and challenges facing the Laboratory. He highlighted forensic analysis as an area for growth. Forensic analysis allows one to better address both the need for broader and deeper analysis of chemical samples, compared to the current focus of ongoing proficiency tests. A more forensics-based approach could be helpful in non-routine mission work, where the samples collected and potential chemicals of interest may go beyond traditional chemical weapons agent considerations. He then noted that the OPCW Central Analytical Database (OCAD) had recently been updated with a number of newly scheduled compounds.
- 17.6 The Board asked Mr Bennett about the types of mass spectrometry data that can be used to match the mass spectrometry data in the OCAD. Mr Bennett mentioned that Orbitrap data can be matched to mass spectrometry data in the OCAD. In addition, the inclusion of high-resolution mass spectrometry data in the OCAD is also being considered, although not all laboratories or countries may have access to the equipment that captures this data.
- 17.7 There was an additional question centred on the newly scheduled chemicals: have these complicated the proficiency tests in any way? Mr Bennett responded that there are already large families of scheduled chemicals that are parts of proficiency tests, so in that sense, there have not been any new complications. However, there are certainly more unknowns with the newly scheduled chemicals, which could complicate sample preparation and analysis, since not all designated laboratories are familiar with these protocols. In addition, the availability of appropriate reference data is not as complete as for other Schedule 1 chemicals. In that sense, the Laboratory is reliant on contributions to the OCAD and published literature to make the database of spectra more robust.
- 17.8 In this discussion with SAB members, it was highlighted that the CCACTs are very useful for States Parties when it comes to strengthening their national laboratory capacities, but that participation in the proficiency tests is not necessarily the next step for these laboratories.

**18. AGENDA ITEM EIGHTEEN – Any other business and closing remarks**

- 18.1 The SAB Chairperson thanked the staff of the Secretariat and the interpretation team for their support at this successful session and noted that he was looking forward to the next in-person meeting. He then thanked all the members for their participation in and contribution to the SAB's Thirty-Fifth Session.
- 18.2 The SAB is grateful to all States Parties, organisations, and institutions that have financially assisted the work of the Board.

**19. AGENDA ITEM NINETEEN – Adoption of the report**

The SAB agreed to adopt the report for its Thirty-Fifth Session via correspondence after the session.

**20. AGENDA ITEM TWENTY – Closure of the session**

The Chairperson closed the session at 12:36 CET on 16 June 2022.

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

	<b>Participant</b>	<b>Institution</b>
<b>Members of the Scientific Advisory Board</b>		
1.	Dr Crister Åstot	Swedish Defence Research Agency (FOI), Sweden
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.	Prof Vladimir Dimitrov	Institute of Organic Chemistry with Centre of Phytochemistry, Bulgarian Academy of Sciences, Bulgaria
7.	Mr Raza Ellahi	Defence Science & Technology Organization (DESTO), Pakistan
8.	Prof Mostafa Ghanei, MD	Baqiyatallah University of Medical Sciences, Iran (Islamic Republic of)
9.	Dr Norman Govan	Defence Science and Technology Laboratory, United Kingdom of Great Britain and Northern Ireland
10.	Dr Matteo Guidotti	Institute of Chemical Sciences and Technology Institute (SCITEC) of the Italian National Research Council, Italy
11.	Mr Wilford Jwalshik	Institute of Chartered Chemists, Nigeria
12.	Dr Robert Kristovich	United States Army DEVCOM Chemical Biological Center, United States of America
13.	Dr Andrea Leisewitz (Vice-Chairperson)	Universidad San Sebastián, Chile
14.	Prof Imee Su Martinez	University of the Philippines-Diliman, Philippines
15.	Prof Elisa Souza Orth	Federal University of Paraná, Brazil
16.	Mr Günter Povoden (Chairperson)	CBRN Defence Centre, Ministry of Defence, Austria
17.	Prof Ines Primožič	University of Zagreb, Croatia
18.	Prof Ahmed E. M. Saeed	Sudan University of Science and Technology, Sudan

<b>Invited Participants</b>		
19.	Dr Alexandre Bennett	Organisation for the Prohibition of Chemical Weapons, Netherlands
20.	Prof Stefano Costanzi	American University, United States of America
21.	Dr Jonathan Forman	Pacific Northwest National Laboratory, United States of America
22.	Ms Luisa Sánchez-Bravo	Organisation for the Prohibition of Chemical Weapons, Netherlands
23.	Dr Ralf Trapp	Independent Consultant, France
24.	Dr Gareth Williams	Organisation for the Prohibition of Chemical Weapons, Netherlands
<b>Secretary to the Scientific Advisory Board</b>		
25.	Dr Peter Hotchkiss	Organisation for the Prohibition of Chemical Weapons, Netherlands