

**NOTE BY THE DIRECTOR-GENERAL****RESPONSE TO THE REPORT OF THE TWENTY-EIGHTH SESSION
OF THE SCIENTIFIC ADVISORY BOARD
10 – 14 JUNE 2019**

1. This Note presents the Director-General's comments on the report of the Twenty-Eighth Session of the Scientific Advisory Board (SAB) (SAB-28/1, dated 14 June 2019) and the ongoing work of the Board.
2. Understanding the impact of scientific and technological evolution is a key aspect of the full and effective implementation of the Chemical Weapons Convention (hereinafter "the Convention"). Given current security concerns, a rapidly evolving technological landscape and an increasing frequency of discussions within policy-making organs that include technical dimensions, the need for sound scientific advice for chemical disarmament and non-proliferation has never been greater. Effectively preventing the re-emergence of chemical weapons and ensuring that the OPCW remains a fit-for-purpose organisation is strengthened through innovation, viewing technological change as opportunity for enhancing capability, and a strong science-policymaker partnership. In this regard, the SAB serves as a valuable resource in bringing sound scientific advice into the decision-making process.
3. The Director-General values the strong commitment to the norms of the Convention and the productive example of international scientific collaboration demonstrated by the SAB. In this regard, the Director-General expresses sorrow on behalf of the Technical Secretariat (hereinafter "the Secretariat") for the passing of SAB member Mr Valentin Rubaylo of the Russian Federation, a dear colleague, a committed member of the SAB, and a good friend.
4. The SAB's advice to the Fourth Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention (hereinafter "the Fourth Review Conference") (RC-4/DG.1, dated 30 April 2018) was the result of an intensive scientific review process carried out over a five-year timeframe. With the Fourth Review Conference behind us, the SAB is embarking on its next scientific review, to develop advice for the next Review Conference. The Director-General encourages States Parties to support the work of the Board with voluntary contributions, and he notes that a formal call was issued in January of this year (S/1703/2019, dated 10 January 2019). The Director-General wishes to thank the Government of Australia for its contribution in 2018, as well as the Kingdom of Saudi Arabia for its voluntary contribution to provide support for the science communication activities of the Secretariat and the SAB.



5. The Director-General would also like to remind States Parties that there are currently 7 open seats on the Board. New members appointed to these seats will begin their terms on 1 January 2020. Appointments will be announced at the Ninety-Second Session of the Executive Council (hereinafter the “Council”) in October 2019.

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

6. The SAB met in The Hague, the Netherlands, for its Twenty-Eighth Session from 10 to 14 June 2019. The session was chaired by Mr Cheng Tang, supported by Vice-Chairperson Dr Christophe Curty. The report of the session was issued as SAB-28/1.
7. In his opening remarks (paragraphs 5.1 to 5.4 of SAB-28/1), the Director-General informed the SAB on developments at the OPCW following the Board’s Twenty-Seventh Session in March 2018 (SAB-27/1, dated 23 March 2018). A number of these developments incorporate aspects of the thematic content of RC-4/DG.1 and the Director-General’s response to that report (RC-4/DG.2, dated 1 June 2018). In particular, discussions addressed the decision on “Addressing the Threat from Chemical Weapons Use” (C-SS-4/DEC.3, dated 27 June 2018) and the proposals to add new chemicals and families of chemicals to the Annex on Chemicals that were discussed at the Sixty-Second and Sixty-Third Meetings of the Council. Against this backdrop, the Director-General emphasised that the OPCW must not lose sight of other significant challenges faced by the Convention, particularly those posed by ensuring the verification regime keeps pace with technological change, preventing the re-emergence of chemical weapons, chemical terrorism, and the critical role of chemical security in preventing the diversion of toxic substances for malicious purposes—all of which include technical dimensions that the Board might consider in its scientific review.
8. Acknowledging that the pace of scientific and technological change shows no sign of slowing, and that with it comes open-ended questions on the impact on the Convention, the Director-General expressed his appreciation for the Board’s efforts to engage with and provide practical views for policymakers. The Board’s perspectives on where emerging tools and new scientific approaches fit into the dynamic and continually evolving operating environment of the Secretariat have helped to institutionalise a productive science-policy maker discourse at the OPCW. Since the Board’s Twenty-Seventh Session, the SAB Chair has provided briefings to States Parties at the Tenth Meeting of the Open-Ended Working Group on the Fourth Review Conference (June 2018),¹ the Fourth Review Conference (November 2018),²

¹ The presentation from this briefing is available at:
www.opcw.org/sites/default/files/documents/SAB/en/20180606_OEWG-RC-Science_and_Technology.pdf.

² The statement and accompanying slides are available at:
www.opcw.org/sites/default/files/documents/2019/01/26_November_2018_SAB_Chair_RC4_Remarks.pdf (statement) and
www.opcw.org/sites/default/files/documents/2018/11/26_November_2018_SAB_Chair_RC4_Slides%20%28002%29.pdf (slides).

on the margins of the Twenty-Eighth Session of the SAB,³ and through the Science for Diplomats Initiative.⁴ The Director-General encourages delegations to attend SAB briefings, as these provide a valuable opportunity to maintain and enhance science-policy discourse. The SAB Chairperson will next brief States Parties at the Twenty-Fourth Conference of the States Parties (hereinafter the “Conference”) in November 2019.

9. After a careful review of the report of the Twenty-Eighth Session of the SAB, the Director-General is pleased to submit the following comments to the Council.

RECOMMENDATIONS TO THE DIRECTOR-GENERAL (PARAGRAPHS 1.3 AND 1.4 OF SAB-28/1)

10. The Director-General thanks the SAB for the recommendations submitted through SAB-28/1. The scientific methodologies employed by the Secretariat must be rigorous and robust, and the Director-General is pleased to see these principles underpinning the SAB-28 recommendations. The Director-General submits the following perspectives on the SAB’s recommendations:
 - (a) Given the high standards to which information collected in non-routine operations is held when used for decision making, the recommendation of sub-paragraph 1.3(a) of SAB-28/1, i.e., to provide the Director-General access to forensic advice through an expert advisor, is of particular relevance. The Secretariat is exploring the modalities of how such an advisory role might be operationalised.
 - (b) In response to sub-paragraphs 1.3(b) and 1.3(c) of SAB/28-1, which contain recommendations looking to ensure that Secretariat staff are suitably trained and follow appropriate operating procedures for any mission with an investigative dimension, the Director-General notes that the Secretariat’s training programmes and operating procedure review process have taken these approaches into account and will continue to do so.
 - (c) In response to sub-paragraph 1.3(d) of SAB-28/1, the Director-General recognises that an ongoing evaluation process for new equipment benefits immediate capability needs and helps to ensure that the Secretariat keeps pace with technological changes. The Director-General has encouraged the Secretariat to identify capability needs and the situations where such capabilities are beneficial. Training scenarios that match these needs with suitable enabling technologies are ideally suited for equipment evaluation.

³ The presentation from this briefing is available at:
www.opcw.org/sites/default/files/documents/2019/06/20190614%20SAB%20Briefing%20to%20States%20Parties.pdf.

⁴ More information about and materials from the Science for Diplomats Initiative is available at:
www.opcw.org/resources/science-and-technology.

UPDATES FROM THE TECHNICAL SECRETARIAT (PARAGRAPHS 6.1 TO 6.15, 7.1 TO 7.3, 13.10 TO 13.13, 14.1 TO 14.4, AND 15.2 TO 15.5 OF SAB-28/1)

11. The Director-General recognises that the formulation of useful and effective science advice is strengthened by ensuring that the SAB is adequately informed of the needs and operational realities of the Secretariat. In this regard, the Director-General views updates provided by the Secretariat to the SAB as a fundamental process within the OPCW's scientific advice mechanism. He thanks the Secretariat staff who provided updates, and especially those who provided feedback on previous SAB recommendations. The Director-General appreciates the open-door policy of SAB proceedings for members of the Secretariat who wish to engage with the Board. He encourages units within the Secretariat to attend and engage in discussions during Board meetings, and especially to liaise with the SAB Secretary for further interactive opportunities. With regard to topics discussed at SAB-28, the Director-General provides the views that follow.
 - (a) In reference to the development of a Chemical Information Repository (paragraphs 6.9 to 6.11 of SAB-28/1), the Director-General considers such a repository an enhancement to the knowledge management capability of the Secretariat. He thanks the members of the SAB who are willing to provide input in support of the initiative.
 - (b) In reference to the Secretariat's review of the Article VI verification regime (paragraphs 6.12 to 6.15 of SAB-28/1), the Director-General is grateful to the SAB for the wealth of consideration that they have provided through their many reports and briefings, much of which has been succinctly summarised in RC-4/DG.1 (paragraphs 30-33 in particular). The Director-General encourages States Parties to consider the SAB's advice with a view to informing deliberations in the Industry Cluster. In this regard, the Director-General also encourages States Parties to recall the SAB's views on the utility of risk-based approaches to verification (paragraph 30 of RC-4/DG.1).
 - (c) In reference to educational resources (paragraph 7.3 of SAB-28/1), the Director-General encourages all relevant stakeholders to collect and share materials developed for chemical safety and security education. Such materials would also be valuable to include in a chemical information repository.
 - (d) In reference to gaining access to enabling scientific research and development (sub-paragraphs 15.4(c) and 15.4(d) of SAB-28/1), training, scenario-planning and lessons learned exercises provide a way forward for identifying the Secretariat's capability needs. Relevant needs could be prioritised and further discussed, with a view toward exploring the potential for States Parties to voluntarily share relevant research and development.

**STAKEHOLDER ENGAGEMENT ACTIVITIES OF THE SAB
(PARAGRAPHS 7.4 TO 7.10 OF SAB-28/1)**

12. The provision of effective science advice requires access to scientific networks, insights from technology developers to aid in horizon scanning, and visibility and credibility across broad scientific communities. The Director-General recognises the SAB's need to draw upon knowledge from a wide range of scientific experts in order to fully assess impact and recognise opportunities from technological change. The Director-General has been impressed by the SAB's ability to engage with experts coming from a range of scientific and engineering disciplines, this practice has significantly enhanced the quality of the Board's work.
13. The Director-General commends Professor Isel Alonso for her role in organising the Thirty-Third Latin American Congress of Chemistry (CLAQ) and Tenth Congress of Chemical Sciences, Technology and Innovation. He appreciates the prominence afforded to the SAB members in attendance. The visibility of and reach into scientific communities provided through such events is vital for maintaining strong ties with technical experts. SAB member involvement in organising scientific events provides an opportunity to raise awareness of the Convention, and complements ongoing cooperation with professional scientific organisations such as the Union of Pure and Applied Chemistry (IUPAC). SAB members have also been afforded the opportunity to engage with diverse scientific communities by participating as speakers in a number of the Secretariat's capacity-building workshops.
14. The Director-General welcomes the publication of the SAB's work in peer-reviewed scientific literature. This practice brings the scientific community's recognition of the credibility of the Board as a scientific body. Furthermore, it brings visibility to the working culture of the Board, exemplifying a productive international scientific collaboration. In this regard, the Director-General wishes to express his appreciation to IUPAC for the October 2018 special edition of its journal "Pure and Applied Chemistry", which contained a series of papers from the 2017 SAB workshop on emerging technologies. The Director-General encourages the SAB to continue the practice of publication in peer-reviewed scientific literature.

**ADVICE ON CHEMICALS (PARAGRAPHS 8.1 TO 8.16 AND 10.1 TO 10.6 OF
SAB-28/1)**

15. The recent proposals to add new chemicals and families of chemicals to the Schedules of the Convention (EC-M-62/DEC.1*, dated 14 January 2019 and EC-M-63/DEC/CRP.1, dated 19 February 2019) have underscored the need for decision makers to have access to technical knowledge of chemicals and chemistry. The Director-General supports the SAB's view that annotating the Annex on Chemicals with chemical structures would better equip decision makers to understand and draw upon key chemistry concepts in their discourse (see paragraph 8.13 of

SAB-28/1).⁵ In this regard, he encourages States Parties to consider the types of chemistry information (and formats) that would be useful to have readily available as resources for delegations. The Secretariat already maintains a collection of informative scientific resource materials and handbooks; additionally, a collated package of materials could be considered for online or documentation counter distribution.

16. The Director-General commends the SAB for its report on new nerve agents (SAB-28/WP.1, dated 3 July 2018), the comprehensive review of available technical information has identified knowledge gaps, inconsistent information in open-source literature, and useful approaches for further consideration. The report has been cited in Schedule change proposals submitted by States Parties, as well as in the Secretariat's assessments of these proposals (EC-M-62/DG.1, dated 14 December 2018; EC-M-63/DG.1 and Corr.1, both dated 29 January 2019, and Corr.2, dated 1 February 2019). The Director-General would also like to thank the States Parties which responded to the request for information to be shared with the SAB (S/1621/2018, dated 2 May 2018). As publications and information on new nerve agents continue to emerge, the Director-General has tasked the Secretariat with maintaining a watching brief on scientific literature. The Secretariat is also taking appropriate action to information relevant information on the pertinent chemical families (paragraphs 8.3 to 8.4 of SAB-28/1). The Director-General welcomes any further technical information that States Parties might wish to contribute to these efforts.
17. The Director-General appreciates the SAB's attention to known and legacy chemical agents and weapons. Knowledge of properties, applications, production methods, reactivity, environmental fate, remediation, decontamination, and suitable analytical methods for chemicals found both within and outside the schedules of the Convention represent a fundamental capability needed for effective implementation of the Convention.

INVESTIGATIVE SCIENCE AND TECHNOLOGY (PARAGRAPHS 9.1 TO 9.14 OF SAB-28/1)

18. The temporary working group (TWG) on investigative science and technology has held three meetings in the period from February 2018 to April 2019; additional meetings are planned in September and November 2019. A final substantive report is expected in early 2020 at the completion of the Group's mandate. The Director-General has carefully reviewed the reports of the TWG and the resultant discussions within the SAB. The TWG has received substantive briefings from inspectors experienced in non-routine operations taking place under challenging circumstances. The Director-General appreciates how the TWG has taken into consideration experiences of current and former members of the Secretariat, the non-routine investigative experiences of other organisations, and the wide range of

⁵ An unofficial version of the Annex on Chemicals annotated with advice from the SAB and useful chemistry information is currently available for use as a resource; [www.opcw.org/sites/default/files/documents/2019/06/Science for Diplomats Annex on Chemicals with Functional Group Table.pdf](http://www.opcw.org/sites/default/files/documents/2019/06/Science%20for%20Diplomats%20Annex%20on%20Chemicals%20with%20Functional%20Group%20Table.pdf).

existing tools and trans-disciplinary approaches that can be applied to provenance and the reconstruction of past events.

19. As demonstrated by the recommendations set out in paragraphs 1.3 and 1.4 of SAB-28/1, findings from the TWG's three reports already provide a solid foundation for formulating advice relevant to the needs of the Secretariat's non-routine missions.
20. The Director-General supports the SAB's view on the value of scenario-based training and approaches for the evaluation of new technologies and methodologies. He appreciates the insights provided by the SAB to Secretariat staff involved in scenario development and planning.

SCIENTIFIC AND TECHNOLOGICAL ELEMENTS OF VERIFICATION TECHNOLOGIES, EMERGING TECHNOLOGIES, NEW EQUIPMENT, AND DEVELOPMENTS IN SCIENCE AND TECHNOLOGY (PARAGRAPHS 11.1 TO 11.8, 13.1 TO 13.9, AND 16.1 TO 16.5 OF SAB-28/1)

21. The review of science and technology is mandated in paragraph 22 of Article VIII of the Convention; Article VIII also serves as the basis for the formation of the SAB. The Director-General is pleased to see the SAB's next scientific review cycle moving ahead without loss of continuity following the publication of RC-4/DG.1.
22. The Director-General appreciates the practical views of scientific advances espoused by the SAB. The Board's approach to assessing technological change through consideration of capability (and under what circumstances) rather than through the lens of a single scientific discipline has greatly benefited decision making processes. The availability of reports of interesting and relevant scientific developments continues unbounded (paragraphs 16.1 to 16.5 of SAB-28/1), yet many new developments have practical limitations that must be understood before there is a clear indication of technological readiness. The Director-General encourages the SAB to remain engaged with innovation communities and those driving scientific change in order to gain deeper insight into the technological readiness of new science and technology.
23. Developments related to verification are of particular relevance to the Convention; paragraph 6 of Article VIII calls on the OPCW to consider measures to make use of advances in science and technology for verification purposes. The presentations at SAB-28 on novel biomarkers of sulphur mustard exposure and "OMICS" approaches for untargeted recognition of toxic chemical exposure (paragraphs 11.3 to 11.8 of SAB-28/1) are relevant examples of such developments.
24. The world is becoming increasingly digitalised, with virtual tools for conducting business so ubiquitous, they are no longer viewed as a "new" technology. These tools are, however, seeing continual improvements that streamline the way business is conducted. This has meaningful impacts on the operating environment of the Secretariat and requires that the OPCW continually improve upon its own processes (paragraphs 13.10 to 13.13 of SAB-28/1). The Director-General commends the SAB for prioritising digitalisation in its watching brief (paragraphs 11.1 and 11.2, and 13.1 to 13.3 of SAB-28/1).

25. Technological change is increasingly driven by digital transformation that is powered by artificial intelligence (AI). This has given rise to a wealth of innovation and security concerns across industries and sectors—the chemical sciences and chemical industry included. The Director-General views digital transformation as a key contributor to twenty-first century scientific and technological change, and that it therefore must be considered in the scientific review process. Digital transformation has great potential for implementation of the Convention. Applications might include real-time recognition of signatures of chemical change (exposure) and access to actionable chemical information for field-deployed personnel.
26. The Director-General appreciates the SAB's view of AI as a component of a technology that, when integrated with other components, enables a capability. With AI-based tools increasingly permeating scientific endeavours, it is imperative to understand their impact, function, limitations, and security implications from a practical perspective that is informative for decision making.

ASSISTANCE AND PROTECTION (PARAGRAPHS 12.1 TO 12.7 OF SAB-28/1)

27. In addition to the importance of science and technology for verification applications, the Director-General recognises a critical need to seize opportunities arising from scientific progress for assistance, protection and capacity-building measures. The Director-General encourages the SAB to continue its engagement with experts in incident response procedures. He highly appreciates the SAB's efforts to bring such experts to the OPCW for presentations that can be attended by Secretariat staff (paragraphs 12.1 to 12.2 of SAB-28/1).
28. Real-time access to information on medical management and decontamination for incident responders serves to strengthen the effectiveness of mitigating the impact of a chemical event. The Director-General recognises that the guidelines and decision-making tools and applications, especially those developed for use in resource-limited settings, are valuable to share with relevant stakeholders. These types of resources could also be a useful addition to a Chemical Information Repository.
29. The Director-General encourages the Secretariat to develop valuable reference and resource materials for use by medical workers, such as the "Practical Guide for Medical Management of Chemical Warfare Casualties" (paragraph 12.5 of SAB-28/1). The Director-General appreciates the SAB's interest in further addressing long-term care issues resulting from chemical agent exposure, and especially the Board's support for the Secretariat's efforts in this area (paragraphs 12.3 to 12.5 of SAB-28/1). The Director-General recognises the gap in available information on this topic and encourages the collation and sharing of toxicological and medical data with those who can benefit from it.
30. The Director-General appreciates the SAB's view on innovative and DIY approaches for gaining access to tools and equipment with assistance and protection relevant to resource-limited and constrained settings (paragraphs 12.6 to 12.7 of SAB-28/1). The Secretariat's science monitoring activities frequently come across reports describing these approaches, many of which are useful for education and training purposes. Of particular interest are field tested examples (including laboratory tools) that can be

both shared with relevant stakeholders through the Secretariat and considered for inclusion in a Chemical Information Repository. The Director-General encourages States Parties to consider innovative approaches to problem solving, as well as the development of low-cost tool, with chemical security benefits in research projects submitted to the OPCW capacity-building programmes.

FUTURE WORK AND OTHER BUSINESS OF THE SCIENTIFIC ADVISORY BOARD

31. The SAB will hold its Twenty-Ninth Session in 2020, at which the Board will follow up on topics flagged for further discussion in SAB-28/1 and continue developing the scope and events of the scientific review toward the Fifth Review Conference. Looking toward the SAB's continued work in 2020, the Director-General congratulates Dr Christophe Curty and Dr Zrinka Kovarik for their election as 2020 Chairperson and Vice-Chairperson of the SAB.
32. The TWG on investigative science will hold its final two meetings in September and November of 2019. The Chairperson intends to brief States Parties on the margins of the Twenty-Fourth Session of the Conference. The Director-General acknowledges the skilful guidance of the TWG Chairperson, Dr Veronica Borrett, and he looks forward to reviewing the final report and considering its recommendations and advice.
33. The SAB will continue its practices of engaging and networking with scientific communities, in particular through conference and workshop attendance and scientific publications, with administrative support provided by the Secretariat. These activities serve to strengthen the insights taken from the review of publications, patents, and other scientific information sources.
34. In 2020, the Secretariat will for the first time initiate a "crowdsourcing challenge" to collect technical information on observable and biomarker based signatures of toxic chemical exposure in plants (paragraphs 6.5 to 6.6 of SAB-28/1). The use of crowdsourcing, which the SAB had proposed as an approach for the Secretariat to consider, opens up new opportunities for engagement with technical communities. The Director-General is grateful to the SAB members who will work with the Secretariat to support this effort. The Secretariat is preparing details for a call for proposals, and the Director-General looks forward to launching the "Plant Biomarker Challenge" in early 2020.
35. The Director-General thanks the European Union for Council Decision 2019/538 of 1 April 2019, which provides funding for both the crowd-source challenge and the work of TWGs.
36. The need for sound and actionable technical inputs to support the implementation of the Convention will only continue to grow, as will the need for strong scientific literacy amongst decision makers. To this end, the SAB serves as a valuable resource, providing science advice and facilitating awareness-raising in technical communities. The Director-General appreciates the quality and substance of the SAB's work and recommendations. He is grateful to all the members of Board for their willingness to stand ready to provide technical advice and guidance in support of the Convention.