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NOTE BY THE DIRECTOR-GENERAL

RESPONSE TO THE REPORT OF THE THIRTY-NINTH SESSION OF THE SCIENTIFIC ADVISORY BOARD

- 1. This Note presents the Director-General's comments on the report of the Thirty-Ninth Session of the Scientific Advisory Board (SAB) (SAB-39/1, dated 4 April 2025) and the ongoing work of the Board.
- 2. With the continued, rapid development of science and technology, the ongoing monitoring of these developments to understand their impact on the Chemical Weapons Convention (the Convention) and the work of the OPCW remains invaluable. The SAB is essential in this endeavour. Its findings and advice provide a solid foundation on which the Director-General, the Technical Secretariat (the Secretariat), and States Parties can base their discussions and decisions.
- 3. Disruptive and emerging technologies require close and continuous examination particularly as fields like synthetic biology and organic chemistry are being fundamentally reshaped by advances in enabling technologies such as artificial intelligence (AI). This technology is redefining the boundaries of scientific discovery, as evidenced by the 2024 Nobel Prizes in Chemistry and Physics, both awarded for seminal advances in the field. The Director-General continues to draw upon the expertise, advice, and recommendations of the SAB for the benefit of the Organisation.

RESPONSE TO THE REPORT OF THE THIRTY-NINTH SESSION OF THE SCIENTIFIC ADVISORY BOARD

- 4. The SAB met for its Thirty-Ninth Session from 1 to 4 April 2025 at the OPCW in The Hague, the Netherlands. The session was chaired by Prof. Imee Su Martinez, with Prof. Elisa Souza Orth serving as Vice-Chairperson. The report of the session was issued as SAB-39/1.
- 5. After carefully reviewing the report of the Thirty-Ninth Session of the SAB, the Director-General submits the following comments to the Executive Council.

RECOMMENDATIONS TO THE DIRECTOR-GENERAL (CONTAINED IN THE EXECUTIVE SUMMARY OF SAB-39/1)

6. The Director-General acknowledges that the advice of the SAB will be valuable to the mission-related work of the Organisation. He supports the involvement of the SAB, as appropriate, in ongoing considerations by the Secretariat regarding mission equipment, whether it be related to detection and identification, personal protection, medical countermeasures, or processes for decontamination or destruction.

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- 7. The Director-General also concurs that the SAB should, where possible, hold several technical, topical workshops in the lead-up to the next Review Conference.¹ Detailed examinations of various, specific areas of relevance to the Convention are important in the formulation of advice by the SAB. In this regard, the Director-General supports the topics proposed by the SAB in its session report and highlights the following as particularly useful and relevant:
 - (a) simple, reliable, and low-cost sensing/detection systems;
 - (b) medical preparedness for incidents involving exposure to toxic chemicals; and
 - (c) science and technology relevant to central nervous system-acting chemicals.
- 8. It is not surprising that science and technology continue to garner particular focus across the Organisation. The SAB has greatly assisted States Parties in understanding the importance and relevance of different emerging technologies to the object and purpose of the Convention. The recommendation of the SAB to further augment the ability of the Secretariat to monitor and understand the impacts of different developments in science and technology dovetails with this focus, recognising the fundamental role science and technology have in the work of the Organisation.

DEMOCRATISATION OF SCIENCE AND TECHNOLOGY (PARAGRAPHS 13.1 TO 13.7 OF SAB-39/1)

- 9. The misuse of science and technology is dependent on a number of variables. Intent, knowledge, capability, and accessibility to materials and equipment all contribute to the potential that a nefarious actor may use a chemical weapon. The work of Prof. Nadya Peek and others to better understand how to increase the availability and accessibility of technical hardware, also known as "democratisation", is an important endeavour. Democratisation of digital fabrication equipment and techniques promises to make technology accessible to a much broader segment of the population, propelling research and discovery forward in regions where access to traditional equipment is often limited. Lowering barriers to entry for these technologies also promotes a more multidisciplinary approach to research and discovery, enabling the combination of different disciplines to address the toughest scientific challenges. Despite these promising benefits, the increased accessibility of knowledge and capabilities should be monitored for potential misuse.
- 10. The boundaries between different scientific disciplines and technologies continue to be blurred, resulting in exciting new discoveries and breakthroughs. They also pose potential risks when it comes to the design and creation of weapons. The Director-General requests the SAB to continue to think broadly about both the opportunities and risks that innovation and scientific discovery present.

Review Conference = Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention.

ADVANCES IN CHEMICAL WEAPONS RESEARCH (PARAGRAPHS 11.1 TO 11.6, 12.1 TO 12.11, AND 14.1 TO 14.4 OF SAB-39/1)

- 11. The OPCW designated laboratories, along with other heralded research institutions worldwide, remain at the vanguard of efforts to advance chemical weapons defence, whether through enhanced detection and identification, improved personal protective equipment, medical countermeasures, or operational tactics. The Director-General recognises the pivotal role that these research institutions play in ensuring that the OPCW, and Member States domestically, have the best possible capabilities to prevent and respond to the use of chemical weapons.
- 12. The Director-General notes with interest the work on visualisation of gases and aerosols that is being conducted by the National Institute of Standards and Technology in the United States of America. Given that many chemical warfare agents are highly toxic and that their presence—even at low concentrations—poses a significant risk, approaches that enhance the detection and localisation of toxic chemicals are particularly valuable. While the application of schlieren optics and laser-sheet imaging in the chemical weapons research space remains limited, there is promising potential for their use in visualising vapour and aerosol plumes to assist in detector placement and development. The Director-General requests that the SAB continue to consider "out-of-the-box" techniques and approaches in the chemical weapons domain.
- 13. The Swedish Defence Research Agency (FOI) and the Netherlands Organisation for Applied Scientific Research (TNO) are two designated laboratories conducting timely and valuable research relating to chemical weapons. At both institutions, there is a focus on developing capabilities to respond to emerging threats. The Director-General notes the attention that both laboratories have given to central nervous system-acting chemicals, helping to elucidate markers from different synthesis routes, detection and identification approaches, and decontamination.
- 14. FOI is researching how riot control agents can be better detected and analysed in the field. The Director-General notes that there is a paucity of information in the literature on the detection of—and exposure to—riot control agents, particularly relating to associated markers. Given recent allegations regarding the use of riot control agents in war, which is a violation of the Convention, a more comprehensive scientific base of information is needed. The Director-General appreciates the work of FOI and other laboratories that are working to expand the available scientific literature on this important topic.
- 15. TNO presented an overview of selected new capabilities related to chemical weapons defence. These included a vehicle equipped with various detectors and protective measures, which is designed to investigate chemical incident scenes, as well as the Chemical Hot Aerosol Research Tool (CHART), a system for studying the effects of toxic chemicals. The Director-General notes that such capabilities may prove useful in ongoing Secretariat training and readiness activities and encourages Secretariat staff to continue engaging and partnering with designated laboratories, and other facilities, that actively conduct research related to chemical weapons to ensure developed capabilities can be leveraged, where possible.

NEW AND IMPROVED APPROACHES TO DETECTION (PARAGRAPHS 15.1 TO 15.8, 16.1 TO 16.6, 17.1 TO 17.4, AND 18.1 TO 18.6 OF SAB-39/1)

- 16. Detection and identification remain fundamental cornerstones in deterring and responding to the misuse of toxic chemicals. The Director-General acknowledges the Board's ongoing attention to this area of research and encourages further focus, particularly in relation to low-cost, ubiquitous detection modalities which may find operational utility in the greatest number of States Parties.
- 17. The work of Dr Michael Schmuker, Dr Michael Weller, Dr Vinod Kumar, and Prof. Fabiana Arduini in developing new sensor technologies and detection approaches is impressive. All four of the researchers are focusing on low-cost, readily available materials that can translate into innovative detection modalities. Of particular note is the "smart dust" concept, which leverages biodegradable, paper-based sensors for the passive detection of toxic chemicals in different environments and employs drones as both dispersal (of the sensors) and detection platforms. This creative approach is versatile, with potential applications in areas facing unknown chemical threats, such as conflict zones or facilities with suspected ties to chemical weapons production or storage.

PESTICIDES: ONGOING CHEMICALS OF CONCERN (PARAGRAPHS 19.1 TO 19.6 OF SAB-39/1)

- 18. The Annex on Chemicals to the Convention lists toxic chemicals and their precursors that have been, or may be, developed or used as chemical weapons, and which States Parties have agreed should fall within the OPCW verification regime. These are not the only toxic chemicals that may be misused as weapons. Chlorine, for example, has been used numerous times as a chemical weapon over the years, and there is increasing concern that riot control agents and central nervous system-acting chemicals, such as fentanyl, could be misused as weapons. In this context, there is ongoing concern that pesticides may be misused to cause harm.
- 19. Pesticides are critical to global livelihoods because of their essential role in maintaining and increasing food production. Despite their importance, many pesticides are inherently toxic chemicals, with harmful effects that extend beyond their intended targets. Of particular concern are insecticides, herbicides, and rodenticides; each of these subclasses has the potential to cause significant harm to large numbers of people if used maliciously.
- 20. The Director-General thanks Dr Moussa Mokhtari for his overview of pesticides, which included the effects of exposure, analysis techniques, and remediation approaches, and requests that the Board consider current concerns and advances in this area and report its findings in its next scientific report in support of the Sixth Review Conference. The Director-General requests that the Board pay particular attention to technologies that are used in pesticide dispersal, such as agricultural drones and sprayers.

UPDATES FROM THE TECHNICAL SECRETARIAT (PARAGRAPHS 6.1 TO 6.5, 9.1 TO 9.8 AND 10.1 TO 10.4 OF SAB-39/1)

- 21. Scientific and technical components underpin almost every aspect of the work of the OPCW. Receiving updates from relevant divisions and offices of the Secretariat is critical for the Board's complete understanding of the current activities of the Organisation, providing context for its provision of advice. The Director-General supports this ongoing approach and appreciates the efforts taken by Secretariat staff to ensure that the SAB has the information it needs to inform its work.
- 22. Of note, the Board received a briefing from the Chief of Cabinet on the current and upcoming activities related to both the Syrian Arab Republic and Ukraine. The Secretariat continues to support these efforts in an objective, professional manner, consistent with its duties under the Convention. In both theatres, future activities will require extensive scientific and technical engagement, including in areas such as detection, identification, and destruction. The Director-General requests that the Board be ready to provide relevant advice if requested.

TEMPORARY WORKING GROUPS OF THE SAB (PARAGRAPHS 7.1 TO 7.4 AND 8.1 TO 8.6 OF SAB-39/1)

- 23. The Temporary Working Group (TWG) on Chemical Forensics has made extensive progress in what is an important area of research. The OPCW increasingly needs to analyse authentic samples to obtain information that goes beyond simply identifying a toxic chemical. This additional information can provide clues about the source of a chemical, for example where or how a toxic chemical was produced, or even storage or environmental conditions the toxic chemical has experienced, and may be critical in an overarching investigation of the misuse of chemicals.
- 24. The TWG on Chemical Forensics has now met four times, with its upcoming fifth meeting planned in June 2025. The Director-General looks forward to the continued progress of this TWG, as its final, end-of-mandate report and the accompanying recommendations will help guide the OPCW's future activities and investment in this important space. The Director-General acknowledges the capable leadership by the TWG Chairperson, Dr Anne Bossée, and its Vice-Chairperson, Dr Simon Ovenden.
- 25. The Director-General notes that the first meeting of the newly started TWG on AI took place a week after the Thirty-Ninth Session of the SAB. Emerging technologies continue to impact the work of the OPCW, and AI—because of its enabling role across multiple scientific and technological domains—has become a particular focus. The Director-General awaits the report of the first meeting of the Group and recognises its compressed schedule as a result of its one-year mandate. The Director-General thanks the Group members, its Chairperson, Dr Catharina Müller-Buschbaum, and its Vice-Chairperson, Prof. Hajar Mousannif, for their time and dedication to an area of technology that is already impacting the Organisation in different ways. The findings of the Group will be instrumental in assisting the Organisation as to how to best incorporate AI-based technologies into its activities as well as to identify and mitigate potential risks.

SAB DISCUSSIONS AND UPDATES (PARAGRAPHS 20.1 AND 20.2 AND 22.1 TO 22.3 OF SAB-39/1)

- 26. The Director-General notes the importance of SAB members not only in bringing their professional experience and expertise to the Board, but also in promoting the work of the SAB and the OPCW in external scientific gatherings. He appreciates the willingness of members to share experiences and knowledge gained from conferences and workshops, and in conducting and publishing research in peer-reviewed journals, all of which contribute to the SAB's collective advice to the Organisation.
- 27. The SAB supports each Review Conference not only in its continuous work in monitoring science and technology, but also via its comprehensive scientific report, compiling important, recent developments in science and technology for each five-yearly conference. The SAB has already started preparations for its next scientific report, which it will submit to the Sixth Review Conference, and is identifying the various topics that will be reviewed and evaluated. Employing a mind map approach during this initial phase will ensure that all relevant topics are covered. It will also ensure that the report is organised in a way that effectively communicates the findings and recommendations of the Board to States Parties, thereby providing a baseline for their discussions prior to and during the Review Conference. The Director-General appreciates the Board's proactive approach to this important endeavour.

CLOSING REMARKS

- 28. The Director-General welcomes, for the first time in its history, the Board having women serve as both Chairperson and Vice-Chairperson. He acknowledges their able guidance of the SAB and thanks them for their leadership. He notes the election of Dr Matteo Guidotti as Chairperson of the Board, and the re-election of Prof. Elisa Souza Orth as Vice-Chairperson, for 2026. The Director-General also extends his thanks to the seven members of the Board who are completing their tenure at the end of 2025, namely: Capt. Elma Lilia Biscotti of Argentina; Prof. Fengxia Sun of China; Dr Anne Bossée of France; Prof. Imee Su Martinez of the Philippines; Prof. Victor Kholstov of the Russian Federation; Dr Nomandla Magnificent Vela of South Africa; and Dr Norman Govan of the United Kingdom of Great Britain and Northern Ireland. Their contributions have been instrumental in ensuring that the advice of the SAB continues to positively impact the work of this Organisation.
- 29. Lastly, the Director-General expresses his thanks to all States Parties, organisations, and institutions that have financially assisted the work of the SAB.

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