

Towards a International Biosecurity Education Network (IBSEN)

**Kathyrn Millett, Malcolm Dando,
Lijun Shang**

*Kathyrn Millett, Biosecure Ltd,
Lincolnshire.
Malcolm Dando, Bradford
University., and
Lijun Shang, Biological
Security Research Centre,
London Metropolitan
University, London.*

Summary

The importance of a globally relevant and continually evolving biological security education is a crucial component of improving biosecurity, and the need for systematic and sustained education for life scientists has been recognised in the past. In this article, we have specifically analysed the structure, approach and lessons learned from the International Nuclear Security Education Network (INSEN) and work of the Advisory Board on Education and Outreach (ABEO) of the Organisation for the Prohibition of Chemical Weapons (OPCW), and propose a similar structure for an International Biological Security Education Network that could be applied to the establishment of a comparable network for biosecurity education for civil society and the Biological and Toxin Weapons Convention (BTWC) to adopt.

Introduction

Although great efforts have been made to promote biological security awareness and education from State Parties and civil society, the progress is still very slow and without an effective and agreed implementation plan. However, State Parties to the Biological and Toxin Weapons Convention (BTWC) have reached a consensus agreement that a radical change in how science and technology is dealt with under the Convention must be a major decision during the current inter-sessional period up to the 10th Review Conference. One such effort is a repeated focus on scientific and technological developments relevant to the Convention and the setting up of a science and technology review mechanism for the Convention. The scientific community has helped to facilitate the negotiation and development of the BTWC for many years and could play a further important role in this effort.^{1,2} A recent workshop organised by the Biosecurity Research Centre, London Metropolitan University, brought together experts from civil society and officials from Geneva to discuss how to move forward in the new inter-sessional process, i.e., presenting as Guests of the Meeting, participating in Side Events and making specific Statements.³ Yet, it was also clear that the international scientific community needs to coordinate more effectively to help clarify important issues such as effective methods of oversight of potential dual-use research, codes of conduct for scientists under the Convention and effective biosecurity education for life scientists. This article, analyses the security education frameworks employed in the nuclear and chemical fields and lay out the case for establishing an International Biological Security Education Network

(IBSEN) as a key element in efforts to cultivate a robust culture of responsibility among life scientists.

Comparable approaches implemented in analogous frameworks in the nuclear and chemistry fields

Building a culture of responsibility within the life sciences with education as its foundational base is a complex, but necessary undertaking, requiring sustained commitment and active participation across a broad array of stakeholders, including, but not limited to, national governments, scientific and technological communities, academia, research institutions, educators, professional scientific organisations and associations, funding bodies, industry, and civil society. It is also clear that developing appropriate and effective educational materials that can apply across many life science disciplines - and embedding them as much as possible within the multitude of educational institutions worldwide - is a daunting task. However, as Novossiolova and Pearson noted in 2011, looking to analogous educational frameworks already successfully in place in similar fields is a useful starting point.⁴ The work of the International Nuclear Security Education Network (INSEN) of the International Atomic Energy Agency (IAEA) and of the Advisory Board on Education and Outreach (ABEO) under the Organisation for the Prohibition of Chemical Weapons (OPCW), provides useful models and lessons for consideration in building a similar framework for biosecurity education.

IAEA Nuclear Security Culture and the International Nuclear Security Education Network (INSEN)

The IAEA has long recognised the importance of a robust security culture in which education and training programmes

play an integral part in creating an overall safety and security culture across the nuclear field.⁶ A nuclear security culture is defined as "[T]he assembly of characteristics, attitudes and behaviour of individuals, organizations and institutions which serves as a means to support and enhance nuclear security"⁷ and emphasises the fundamental role played by training and education in its establishment and sustainability.⁸

Instilling the correct beliefs and attitudes throughout facilities lies at the core of a universal and sustained nuclear security culture - a key problem that still besets biosecurity efforts within the life sciences communities.⁹ This involves making sure that all relevant parties understand that i) a credible threat exists and ii) nuclear security is important in preventing that threat from emerging.¹⁰

Following its first articulation of the importance of a security culture in 2000,¹¹ the IAEA has since instituted a continuously updated series of documents since 2006, entitled *the IAEA Nuclear Security Series*, which provides "international consensus guidance" on all aspects of nuclear security.¹² Under this Series, the Agency has published several documents related to developing educational courses to build nuclear security culture.¹³ Having noted in 2008 that "a systematic approach to training and qualification [is needed]... for an effective nuclear security culture",¹⁴ the IAEA first published technical guidance in 2010 on a university-level model educational programme, which has since been updated in 2021.¹⁵ The model curriculum was created in consultation with academic experts and aimed at Master's degree level or an academic certificate programme, for use by university curriculum developers and others, in their educational institutions.¹⁶

Strengthening education and awareness-raising as the prime factor in establishing a flourishing nuclear security culture was further reinforced in 2010, with the establishment of the International Nuclear Security Education Network (INSEN).¹⁷ The INSEN is a partnership between the IAEA and universities, research institutions and other stakeholders, "to promote sustainable nuclear security education."¹⁸ Established during an IAEA workshop on nuclear security education to discuss how better to assist States in this area, the network aims "to enhance global nuclear security by developing, sharing and promoting excellence in nuclear security education" in support of which, the network collaboratively develops and shares educational and professional development materials for students and faculty.¹⁹ To date, their activities have included, inter alia, the development of, and quality assurance on, peer-reviewed textbooks and computer-based teaching tools, the establishment of faculty and student exchange programmes, surveys on the effectiveness of nuclear security education, and the development and implementation of specialised degree programmes and courses, in addition to sponsorship of professional development courses.²⁰

In terms of structure, the membership of the network is informal and open to any educational and research institution or competent authority interested in, involved in, or planning, future nuclear security education, and currently counts 198 members from 66 countries and international organisations.^{21,22} The network currently comprises three working groups that meet annually and focus on "exchange of information and development of teaching materials for nuclear security education" (Working Group 1), "Faculty development and cooperation among universities" (Working Group 2), and "promotion of

nuclear security education" (Working Group 3). In addition to the Working Groups, *Ad Hoc* Groups are convened when necessary to address issues on nuclear security education that transcend the mandate of INSEN Working Groups. During annual meetings, members review the activities of the Working Groups, discuss and identify issues to be addressed, and collectively task Working Groups to create actions plans accordingly. The Chairperson of the meeting is elected for a year.

The IAEA supports INSEN by convening the annual meetings, compiling subjects for discussion in consultation with INSEN members, and reporting on the implementation of activities. The IAEA also hosts and maintains the INSEN online hub on its restricted Nuclear Security Information Portal (NUSEC), which provides INSEN with the infrastructure for promoting, managing, disseminating, and preserving nuclear security; for communication and exchange of information; and for storing information and establishing databases with relevant materials. The IAEA also organizes meetings for its Working Groups and provides a crucial role in promoting and disseminating the work of the Network to its member states.

Chemical Weapons Convention and the Advisory Board on Education and Outreach (ABEO)

Almost since its inception, the Organisation for the Prohibition of Chemical Weapons (OPCW) has recognised and promoted the role of education and outreach as essential for the future implementation of the Chemical Weapons Convention (CWC) and in preventing the re-emergence of chemical weapons. The OPCW's efforts began in 2001 with the launch of the Ethics Project that aimed to increase awareness of the OPCW and its objectives among relevant professions

and in higher education. It has since expanded and evolved due to the establishment firstly, of the Temporary Working Group (TWG) on Education and Outreach under the Scientific Advisory Board (SAB)²³ in 2011, and secondly, the Advisory Board on Education and Outreach (ABEO) in 2015.^{24, 25}

In its Final Report in 2014, the SAB Temporary Working Group emphasised that education and outreach are integral components of preventing the re-emergence of chemical weapons, and made two key recommendations:²⁶ 1) Education and outreach with respect to the responsible use of science, particularly as it is relevant to the Convention, should remain a core activity of the OPCW, so as to achieve and maintain a world free of chemical weapons; and 2) An ongoing expert advisory group on education and outreach with respect to the responsible use of science, particularly as it is relevant to the Convention, should be established to help the OPCW fulfil its mandate for education and outreach, and to ensure that activities and practices are grounded in science education and communication research findings and effective practices.

Accordingly, in 2015, States Parties decided to establish the ABEO with a mandate to advise the Director-General or States Parties on matters of education, outreach and awareness-raising, and public diplomacy concerning the Chemical Weapons Convention (CWC) and its international and domestic implementation in relation to States Parties and key stakeholder communities.²⁷ The Board comprises a gender- and geographically-balanced membership of 15 individuals drawn from CWC States Parties with appropriate expertise in subjects such as education, science communication, the chemical industry, dual/multiple-use issues related to chemistry and the life sciences, and ethics and the Chemical Weapons

Convention. Each member serves as an independent expert.

The Board operates at very low cost, meeting twice a year in person at The Hague with funding provided under the annual OPCW general budget for flights, hotels and per diems. Additional external funding for specific projects can also be sought. To facilitate communication between Board members between meetings, the OPCW hosts an electronic discussion platform which also allows for hosting sub-groups in which ABEO Members, as well as observers, can develop ideas and discuss working papers on topics decided at preceding meetings.²⁸

In line with its Strategic Plan, the ABEO has focused on activities that meet its key education and outreach (E&O) goals, namely: (a) Provide advice on E&O activities to the Director-General, and to States Parties and other stakeholders that is effective, sustainable, cost-effective, and benefits from the latest advances in E&O theory or best practice; (b) Develop a portfolio of E&O activities and projects that benefits the broadest range of stakeholders; (c) Increase awareness of the work of the OPCW among key target audiences, particularly non-specialised audiences; and (d) Improve the reach of the OPCW's activities, also through e-learning, both at the national and regional levels, including through the systematic translation of materials into the OPCW's official languages.²⁹

Among its first activities, the ABEO produced a number of recommendations on activities to be undertaken by the OPCW such as the publishing of a dedicated webpage for the CWC's 20th Anniversary Year along with a series of commemorative events, and youth outreach and engagement of civil society during sessions of the Conference of the States Parties. Working Groups were established to a) consider how

to assist National Authorities with carrying out education and outreach activities; and b) engage specific stakeholder communities such as scientific associations, industry, and professional organisations; as well as ways to engage with other international organisations in promoting peace and disarmament education and youth outreach. Currently, the Board will also continue to focus on the following: e learning, raising awareness of the OPCW's mission worldwide, providing assistance to National Authorities upon their request, and connecting with the chemical industry, academia, and professional associations.³⁰

While mainly an advisory body and often called upon to provide advice on specific issues by the Director-General of the OPCW Technical Secretariat, such as developing a portfolio of specific E&O activities and projects that the Organisation, States Parties, that the ABEO and its individual members should pursue as a matter of priority, the ABEO has initiated and produced, or provided substantive input to shape a wide range of educational and outreach enterprises at the OPCW including, *inter alia*, factsheets, educational videos, course modules and materials, OPCW display materials at its Visitor Centre and for events such as commemorating the centenary of the first large-scale use of chemical weapons at Ieper in Belgium.

Key lessons from the INSEN and ABEO for an international biosecurity educational network (IBSEN)

As pointed out by Perkins *et al* in 2019:³¹ “to improve the culture of biosafety, biosecurity, and responsible conduct, the life sciences will have to pay more attention to lessons learned in other fields and to adapt those tools and frameworks to the life sciences context.” Experiences from the INSEN and ABEO demonstrate the utility

of creating bodies that focus on the creation and rolling evolution of educational and awareness-raising materials, and especially the impact of international networks that collaborate and share materials in close collaboration with treaty regimes.

An examination of the activities and set-up of INSEN and the ABEO provides a number of key lessons that should inform considerations on the establishment of an international biosecurity education network (IBSEN). It is worth noting that a number of these lessons overlap with the lessons from past biosecurity education and awareness-raising activities identified in the *WHO Global Guidance Framework (2022)*³².

Key components of the success of the INSEN are the IAEA and States' full appreciation that nuclear security is first and foremost a national responsibility, and that human resource development and a robust nuclear security culture are key factors in preventing the misuse of nuclear and radiological materials and knowledge.

The IAEA has consistently incorporated support for nuclear security education within its Strategic Plans as one of its core activities.^{33, 34} Similarly, while slower to fully link education and awareness-raising efforts to the success of chemical security, the OPCW has recognized that “public engagement, education, and awareness-raising” must become “an integral part of OPCW activities”³⁵ and over time has developed a number of resources including e-learning modules (that are currently under revision with the input of the ABEO), the FIRES Documentary Video Project, and the Multiple Uses of Chemistry website of resources for students and educators.³⁶

Without sustainable financial support, education and outreach efforts cannot provide necessary up-to-date educational

and training materials, hold valuable workshops and training events, and achieve maximum reach and effectiveness. The IAEA has integrated financial support for the INSEN into its General Budget and provides in-kind support such as hosting and organizing INSEN meetings. In 2023, the planned budget line for the sub-programme on "education and training programmes for human resource development", which includes support for INSEN as well as the funding for the development of materials, totalled •454,524.³⁷

The OPCW also financially supports the work of the ABEO, but its lack of direct financial support beyond funding in-person ABEO meetings has hindered the development of new materials and broader engagement with relevant stakeholders, such as industry and educational establishments. A report by the ABEO in 2021 stressed a significant weakness affecting the work of the Board was the lack of secure funding for activities which contributed to 'a sense of inability to perform serious long-term tasks that require human, financial and institutional expenditure' and a "barrier to undertaking E&O activities".³⁸ Indeed, it was pointed out that certain costs related to ABEO work were borne by ABEO members themselves, which is somewhat shocking when taking into consideration that the OPCW's overall budget totalled •75,988,858 for 2023.³⁹ Lacking a dedicated budget line for active projects, the ABEO has relied on external funding sources for some projects. For example, the EU Council Decision 2019/538 is providing funding for "a tailored programme for education and outreach on chemical safety and security management for youth/students in schools/universities in the context of the peaceful uses of chemistry" and support for ABEO advice on the design and execution of new e-learning modules.⁴⁰

The development and implementation of a comprehensive strategic plan with clear goals and priorities, focused energy and resources, and set responsibilities and pathways for communication between relevant stakeholders is essential to provide direction and put effective education, awareness-raising, and outreach activities into practice.

The INSEN meets annually to set priorities, review, and provide updates on activities, and organise future work of its Working Groups, in light of the needs identified by network members and in support of the IAEA Nuclear Security Plan. In this way, INSEN is able to fluidly adjust and redirect its resources to where they are most needed and continues to ensure that all stakeholders are working towards a common goal.

The ABEO, however, as an Advisory body, is more reactive in that it is able only to respond to *ad hoc* requests from the OPCW Director-General, Technical Secretariat and States Parties. This lack of a clear strategy and its detrimental effect has also been noted within the OPCW itself with regard to its education projects:⁴¹ "the development of the Organisation's external e-learning offering had occurred in an ad hoc way, with relevant units required to independently identify needs and funding for new modules. This resulted in an external e-learning offering that lacked a certain overall coherence and was aimed at a limited range of external stakeholders. The fact that the Organisation had no internal expertise on e-learning compounded this issue."

In addition, without clear, regular lines of communication, defined responsibilities and mechanisms for engagement between all the relevant stakeholders within networks and the treaty regime it supports, any initiatives undertaken risk being hampered.⁴²

Part of the INSEN's success has been due its extensive and broad membership. As an open network, the network has expanded year on year to its current membership of almost 200 institutions across all geographical regions, with more than 80 per cent providing nuclear security education at their home institutions. The 2022 INSEN annual meeting featured presentations from over 20 INSEN members from different countries and its annual rotation of Chairs and Vice-Chairs of the Network and Working Groups ensures continued geographically-diverse engagement. The appointment of Regional Group Representatives helps highlight regional perspectives and priorities, while meetings of the regional groups provide opportunities for regional collaboration. The openness of the Network to any relevant institution that implements or plans to implement nuclear security education ensures that the nuclear education field as a whole is kept apprised of efforts worldwide and encourages innovation and new approaches from across the world.

Equally important is the ability to engage with a wide variety of stakeholders from target audiences such as students, teaching faculty and National Authorities to liaison with States, media, research councils, relevant science and technology communities, industry, civil society, professional societies and associations and others.⁴³ The flexibility and ability to liaise with stakeholders is especially important in relation to a biological security education network due to the breadth of disciplines within the life sciences and the dynamic pace of advances.

The INSEN meetings and ABEO members' presentations at OPCW meetings demonstrate that these meetings present an opportunity for educators to share knowledge and discuss best practices

amongst each other as well as with international organizations and agencies. They discuss, compare, and learn from each other, and establish links and collaborations. They also serve to keep each other apprised of key issues in the nuclear and chemical security fields, such as developments in science and technology that affect the security environments, and bring support to bear on important issues such as the promotion of gender and diversity. They share information on curricula, teaching methodologies and exchange, identify priority topics both internationally and regionally. Together, the IAEA and INSEN have spearheaded efforts to encourage gender parity through initiatives such as the Women in Nuclear Security Initiative (WINSI) and the Marie Skłodowska Curie Fellowship Programme since 2016.

Discussion and Conclusion

The decision at the 2022 Biological Weapons Convention Ninth Review Conference to establish a new "Working Group on the strengthening of the Convention" with a mandate to address issues including "Measures on national implementation of the Convention", presents a renewed opportunity to take decisive action to pioneer new biosecurity education and awareness-raising initiatives. Founding and sustainably funding an International Biosecurity Education Network-a concept already supported by a number of experts-would be a significant step forward in heightening biological security and ensuring that life scientists have the tools and knowledge to realise their obligations to prevent and mitigate the misuse of biology.⁴⁴ Last but not least, the continuous and creative collective inputs from civil society would enhance biological security education and eventually catch up with the rapid advancements in science and technology.

Endnotes:

- ¹ Shang L, Dando M. (2023) Rethinking biosecurity in the 21st century: An enhanced role for civil society. *Journal of Biosafety and Biosecurity*, **5**(3):100-106
- ² Shang L, Sheff L and Dando M. (2023) A key role for scientists in strengthening the Biological Weapons Convention. *Front. Polit. Sci.* **5**:1265008. doi: 10.3389/fpos.2023.1265008
- ³ Magne I, et al. (2024) Toward a collaborative, collective and integrative international CBRN security education. London Policy Workshop. London Metropolitan University. 16 March, 2024
- ⁴ Novossiiova, T. and Pearson, G. S. (2011), *Biosecurity Education for the Life Sciences: Nuclear Security Education Experience as a model*, Bradford Briefing Paper No. 5 (University of Bradford). https://opbw.org/sbtwc/3_BP_5.pdf. (Page 4).
- ⁵ Similarly to the biological field, recognition of the human factor in causing incidents was a primary motivator in efforts to establish a safety culture within the nuclear field. The nuclear accidents at Three Mile Island (1979) and Chernobyl (1986) found human error in both design and operation to be key causal factors behind both incidents, which in turn led to a more concerted effort to establish a 'safety culture' at nuclear facilities. It was not until the 1990s that this concept began to be used in relation to nuclear security and took until 2008 until it was explicitly recognized that 'a human factor is generally a contributor to all nuclear-security related incidents' (see: International Atomic Energy Agency (2008), *Nuclear Security Culture: Implementing Guide*, IAEA Nuclear Security Series No.7. International Atomic Energy Agency, Vienna. ISBN 978-92-0-107808-7 (electronic version). https://www-pub.iaea.org/MTCD/publications/PDF/Pub1347_web.pdf. (Page 5).
- ⁶ International Atomic Energy Agency (2008), *op. cit.* (Page 1).
- ⁷ The IAEA framework for nuclear security culture contains 37 characteristics separated into beliefs and attitudes, principles for guiding decisions and behaviour, management systems, personnel behaviour and leadership behaviour. These are linked to over 200 associated performance indicators, which provide guidance for organisations looking to practically cultivate an effective security culture.
- ⁸ International Atomic Energy Agency (2021), *Technical Guidance: Model academic curriculum in nuclear security*, IAEA Nuclear Security Series No. 12-T (Rev.1). International Atomic Energy Agency, Vienna. ISBN 978-92-0-132820-5. https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1930_web.pdf. (Page 1).
- ⁹ International Atomic Energy Agency (2008), *op. cit.* (Page 19).
- ¹⁰ Ibid.
- ¹¹ *Ibid.* For a short history of the evolution of the IAEA's recognition, definition and endorsement of a nuclear security culture, see: International Atomic Energy Agency (2008), *op. cit.* (Pages 1-2).
- ¹² The IAEA issues four types of documents within its Nuclear Security Series: *Nuclear Security Fundamentals* (objectives, concepts and principles of nuclear security and providing the basis for security recommendations); *Recommendations* (best practices that should be adopted by States in the application of the Nuclear Security Fundamentals); *Implementing Guides* (further elaboration of the Recommendations in broad areas and suggested measures for their implementation; and *Technical Guidance* (Reference Manuals, with detailed measures and/or guidance on how to apply the Implementing Guides in specific fields or activities) as well as Training Guides that cover the syllabus and/or manuals of Agency training courses. See IAEA, Nuclear Security Series, <https://www.iaea.org/resources/nuclear-security-series>.
- ¹³ The IAEA's impetus to create a model academic programme was first embedded in its *Nuclear Security Plan 2006-2009* which emphasised "the importance of human resource development to assist States in building capacity to establish and maintain appropriate nuclear security to prevent, detect and respond to malicious acts involving nuclear and other radioactive material..." International Atomic Energy Agency (2006), *Implementation of the IAEA Nuclear Security Plan 2006-2009*. International Atomic Energy Agency, Vienna. <https://www.iaea.org/sites/default/files/nsplan0911.pdf>. Successive Nuclear Security Plans have continued to support educational and training activities.

- ¹⁴ International Atomic Energy Agency (2008), *op. cit.* (Page 1).
- ¹⁵ The IAEA's 2010 *Educational Programme in Nuclear Security* Technical Guidance (<https://www.iaea.org/publications/8363/educational-programme-in-nuclear-security>) was superseded by the 2021 *Model Academic Curriculum in Nuclear Security*. (International Atomic Energy Agency (2021), *Model Academic Curriculum in Nuclear Security*, Technical Guidance, IAEA Nuclear Security Series No. 12-T (rev.1), International Atomic Energy Agency, Vienna. ISBN 978-92-0-132720-8. <https://www.iaea.org/publications/13608/model-academic-curriculum-in-nuclear-security>). Other key publications on education include: *Safety Culture in Nuclear Installations: Guidance for Use in the Enhancement of Safety Culture*, IAEA-TECDOC-1329, IAEA, Vienna (2002); *Nuclear Security Culture*, IAEA Nuclear Security Series No. 7 (2008); *Objective and Essential Elements of a State's Nuclear Security Regime*, IAEA Nuclear Security Series No. 20 (2013); and, *Building Capacity for Nuclear Security*, IAEA Nuclear Safety Series No. 31-G (2018). There are also a number of training guides focused on developing professional capacities within specific nuclear areas. These can all be accessed at: <https://www.iaea.org/resources/nuclear-security-series>.
- ¹⁶ International Atomic Energy Agency (2021), *op. cit.* (Page 2).
- ¹⁷ The importance of collaborative networks in nuclear security education has enjoyed high levels of support for over 10 years as evidenced by the IAEA Ministerial Declarations from the 2013, 2016 and 2020 International Conferences on Nuclear Security. See, for example, the *Ministerial Declaration from the 2020 Conference*: <https://www.iaea.org/sites/default/files/20/02/cn-278-ministerial-declaration.pdf>.
- ¹⁸ International Atomic Energy Agency, International Security Education Network: <https://www.iaea.org/services/networks/insen>.
- ¹⁹ *Ibid.*
- ²⁰ *Ibid.*
- ²¹ See https://inis.iaea.org/collection/NCLCollectionStore/_Public/45/070/45070873.pdf?r=1
- ²² International Atomic Energy Agency and International Nuclear Security Education Network, *Chair's Report*, Annual Meeting of the International Nuclear Security Education Network. International Atomic Energy Agency, Vienna. 18-22 July 2022. <https://www.iaea.org/sites/default/files/22/11/insen-chair-report-2022.pdf>.
- ²³ Organisation for the Prohibition of Chemical Weapons (2014), *Education and Engagement: Promoting a Culture of Responsible Chemistry*, Final Report of the Scientific Advisory Board's Temporary Working Group. https://www.opcw.org/sites/default/files/documents/SAB/en/Education_and_Engagement-v2.pdf. (Page 6).
- ²⁴ Organisation for the Prohibition of Chemical Weapons (2015), *Establishment of an Advisory Board on Education and Outreach*, C-20/DEC.9. https://www.opcw.org/sites/default/files/documents/CSP/C-20/en/c20dec09_e_.pdf.
- ²⁵ For a full account of the history of education and outreach activities conducted by the OPCW since its establishment in 1997-2012, see: Organisation for the Prohibition of Chemical Weapons (2014), *Education and Engagement: Promoting a Culture of Responsible Chemistry*, Final Report of the Scientific Advisory Board's Temporary Working Group. https://www.opcw.org/sites/default/files/documents/SAB/en/Education_and_Engagement-v2.pdf.
- ²⁶ *Ibid.* (Page 7).
- ²⁷ Chemical Weapons Convention (2015), *op. cit.*
- ²⁸ See: Organisation for the Prohibition of Chemical Weapons, Advisory Board on Education and Outreach, *Statement by Dr Jean Pascal Zanders, Chairperson of the OPCW Advisory Board on Education and Outreach, to the 21st Conference of the States Parties to the Chemical Weapons Convention*, The Hague, 1 December 2016. https://www.opcw.org/sites/default/files/documents/CSP/C-21/en/2016i201_opcw_csp21_abeo_statement_website.pdf.
- ²⁹ Organisation for the Prohibition of Chemical Weapons, Advisory Board on Education and Outreach, *Report of the Tenth Session of the Advisory Board on Education and Outreach*, Annex 2. ABEO-10/1. 10 February 2021. <https://www.opcw.org/sites/default/files/documents/2021/03/abeo-10-01%28e%29.pdf>

- ³⁰ Organisation for the Prohibition of Chemical Weapons, Advisory Board on Education and Outreach, *Report of the Fourteenth Session of the Advisory Board on Education and Outreach*, ABEO-14/1. 9 February 2023. <https://www.opcw.org/sites/default/files/documents/2023/04/abeo-14-01%28e%29.pdf>.
- ³¹ Perkins, D. *et al* (2019), The culture of biosafety, biosecurity, and responsible conduct in the life sciences: A comprehensive literature review, *Applied Biosafety*, **24**:1. <https://www.liebertpub.com/doi/full/10.1177/1535676018778538>. (Page 41).
- ³² World Health Organization (2022), *op. cit.*
- ³³ See, for example, the IAEA *Nuclear Security Plan 2022-2025*, GC(65)/24, 15 September 2021. International Atomic Energy Agency, Vienna. <https://www.iaea.org/sites/default/files/gc/gc65-24.pdf>.
- ³⁴ International Atomic Energy Agency, *Nuclear Security Report 2022*, GOV/2022/31-GC(66)/8, 29 July 2022. <https://www.iaea.org/sites/default/files/gc/gc66-8.pdf>. For the IAEA e-learning portal, see <https://elearning.iaea.org/m2/course/index.php?categoryid=48>.
- ³⁵ Organisation for the Prohibition of Chemical Weapons (OPCW), *Open-Ended Working Group on Future Priorities of the OPCW Recommendations to the Fourth Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention*. 16 July 2018. <https://www.opcw.org/sites/default/files/documents/2018/07/rc4wp01%28e%29.pdf>. (Page 7).
- ³⁶ See <https://www.opcw.org/resources/education-and-outreach>.
- ³⁷ International Atomic Energy Agency, *The Agency's Programme and Budget 2022-2023*, GC(65)/2, July 2021, Vienna, <https://www.iaea.org/sites/default/files/gc/gc65-2.pdf>. (Page 132).
- ³⁸ Organisation for the Prohibition of Chemical Weapons, ABEO (2021). *Op. cit.*
- ³⁹ See <https://www.opcw.org/media-centre/opcw-numbers>.
- ⁴⁰ European Union, Council Decision (CFSP) 2019/538 of 1 April 2019 in support of the Organisation for the Prohibition of Chemical Weapons (OPCW) in the framework of the implementation of the EU Strategy against Proliferation of Weapons of Mass Destruction. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D0538>.
- ⁴¹ Organisation for the Prohibition of Chemical Weapons, Advisory Board on Education and Outreach (2016), *Report of the Second Session of the Advisory Board on Education and Outreach*. ABEO-2/1. https://www.opcw.org/sites/default/files/documents/ABEO/abeo-2-01_e_.pdf. (Page 4).
- ⁴² *Ibid.*
- ⁴³ Available at https://www.opcw.org/fileadmin/OPCW/EC/83/en/ec83s01_c21s01_e_.pdf.
- ⁴⁴ See for example, Shang, L. *et al* (2022), Key issues in the implementation of the Tianjin Biosecurity Guidelines for Codes of Conduct for Scientists: A survey of biosecurity education projects, *Biosafety and Health*, 4:5. <https://doi.org/10.1016/j.bsheal.2022.08.003>. (Pages 339-346); Novossiova and Pearson (2011); Perkins *et al* (2019).