

# The nun who broke America's nuclear sanctum: the use of case studies in CBRN nonproliferation training

Sarah Tzinieris, \* Zenobia S. Homan\*\*

## Abstract

The article examines the use of case studies to support training programs focused on the nonproliferation of chemical, biological, radiological, and nuclear (CBRN) materials and equipment. It argues that educational methods that induce 'deep learning' help to impart a more comprehensive and meaningful understanding of the subject matter. CBRN-focused training and development courses have seen substantial growth in recent years, reflecting an increasing recognition of the major risks posed by CBRN proliferation. However, there remain obstacles to implementing such programs, both due to the limited resources available and the need to educate a diverse and global-dispersed community of practitioners. Pedagogical methods that place the trainee at the center of the teaching process are known to induce a deeper understanding and develop critical thinking skills. Case studies are particularly effective in this endeavor as they offer a dynamic means of grounding complex or intangible concepts into relatable, realistic situations. Case studies also induce a storytelling quality, a mnemonic device that helps learners recall large amounts of information and for long durations. The article argues however that the selection of case studies requires improvement to reduce bias. There is a current lack of

\* Dr Sarah Tzinieris is a Research Fellow in the Centre for Science & Security Studies (CSSS) within the Department of War Studies at King's College London. She holds a PhD and MPhil in International Relations from the University of Cambridge. Sarah's research interests are wide-ranging, but most recently she has focused on coercive diplomacy, sanctions, deterrence, strategic technologies, and critical minerals within the framework of US-China strategic competition. She also supports the UK's Nuclear Security Capacity Building Programme, an academia-industry consortium led by King's College London. Sarah is a co-editor of *The Oxford Handbook of Nuclear Security* published by Oxford University Press, the first comprehensive academic volume on nuclear security. She is on the Advisory Board of the *Compass Journal* of the UN Security Council's 1540 Committee.

\*\* Dr Zenobia S. Homan coordinates international professional development courses, workshops and related capacity building on CBRN security at the CSSS and King's Institute of Applied Security Studies, King's College London. She currently conducts research relating to security culture, education, communication and access to information. Dr Homan is also the 2024 Chair of Working Group II (curriculum development) of the International Nuclear Security Education Network (INSEN) at the International Atomic Energy Agency (IAEA). Zenobia holds a BA Joint Honours degree from Durham University, MPhil from the University of Cambridge, and PhD from SOAS London.

## Article info

Article part of the JoSTC Special Issue Vol. 2, September 2024, "Training programs to counter current and emerging biological and chemical proliferation risks: themes, practices, and lessons learnt". Guest editors: Tatyana Novossiiova, Tom De Schryver. JoSTC Editor-in-chief: Veronica Vella

## How to cite

Sarah Tzinieris, Zenobia S. Homan, "The nun who broke America's nuclear sanctum: the use of case studies in CBRN nonproliferation training", *Journal of Strategic Trade Control*, Special Issue Vol. 2, (September 2024). DOI: 10.25518/2952-7597.113

## Publisher

European Studies Unit (ESU), University of Liège

## Peer review

This article has been peer-reviewed through the journal's standard double-anonymous peer review, where both the reviewers and authors are anonymized during review.

## Copyright

2024, Sarah Tzinieris, Zenobia S. Homan. This is an open-access article distributed under the terms of the Creative Commons Attribution Licence (CC BY) 4.0 <https://creativecommons.org/licenses/by/4.0/>, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

## Open access

The Journal of Strategic Trade Control is a peer-reviewed open-access journal. Accessible at [www.jostc.org](http://www.jostc.org)

## The nun who broke America's nuclear sanctum: the use of case studies in CBRN nonproliferation training

---

diversity in available case studies, and for too long, case studies have tended to reflect Western priorities and may not be easily relatable to non-Western audiences. Lastly, the article emphasizes that the utility of the case study approach comes down to how effectively they are curated within a broader curriculum as well as how well they are taught, which requires skillful facilitators who can cultivate a dynamic and engaging discussion.

### Keywords

Case approach, case studies, CBRN, CBRN training, deep learning, nuclear security, professional education, Y-12.

## Introduction

In July 2012, an 82-year-old Catholic nun and two other anti-nuclear protesters broke into the Y-12 nuclear weapons site in Tennessee, which until then was considered America's most secure nuclear facility. Sister Megan Rice and her two co-defendants were later convicted of sabotage and given custodial sentences of between three and five years. During the break-in, the activists cut through three security perimeters to reach the site's nuclear storage bunker, recently constructed to the tune of half a billion US dollars.<sup>1</sup> On reaching the bunker, which stored much of America's weapons-grade uranium, they daubed the walls with biblical references and human blood.<sup>2</sup>

Why is this story so compelling? It is a case study often used in the training of nuclear security professionals. Tapping into the minds and emotions of people through storytelling is one of the most effective ways to help them improve memory and retain facts, especially when stories are as captivating as that involving Sister Megan. Reader, if you were to close your eyes now, almost certainly you would recall that this story is about an elderly nun breaking into a nuclear site; most probably you would also remember it was supposed to be a very secure nuclear site and that the activists used blood during their protest; if you were concentrating hard you would recall that they cut through multiple security perimeters, were convicted of sabotage, and the site cost half a billion dollars to construct.

A case study is an account or narrative that provides detailed information on how a person, group, or thing develops in order to demonstrate general principles.<sup>3</sup> Case studies are essentially stories that present realistic and contextually rich situations, and they often involve a dilemma or problem to resolve.<sup>4</sup> Employed in both teaching and research contexts, it is this critical thinking element that defines the case study approach. In so doing, case studies offer a dynamic means of grounding complex or intangible concepts into realistic situations that people can relate to. In a teaching environment, trainees or students are able to identify the parameters of an issue and then go on to evaluate the various courses of action. Rather than focusing on generic theories in isolation, they can make decisions

---

<sup>1</sup> "Nun, 84, sentenced to three years in jail for nuclear break-in", *The Guardian*, February 19, 2014, <https://www.theguardian.com/world/2014/feb/19/nun-jailed-break-in-nuclear-plant>.

<sup>2</sup> Eric Schlosser, *Gods of Metal* (Penguin, 2015).

<sup>3</sup> Based on the definition of 'case study' provided by the Cambridge Dictionary, online.

<sup>4</sup> "Case Studies", Eberly Centre, Carnegie Mellon University, accessed October 16, 2023, <https://www.cmu.edu/teaching/designteach/design/instructionalstrategies/casestudies.html>.

## The nun who broke America's nuclear sanctum: the use of case studies in CBRN nonproliferation training

based on analyzing all of the information available.<sup>5</sup> In these conditions, trainees or students are able to engage with the nuances and complexities of any given situation, probing the implications of different courses of action.<sup>6</sup>

This article examines the use of case studies to support training and development programs focused on the nonproliferation of chemical, biological, radiological, and nuclear (CBRN) materials and equipment. CBRN-focused training and development programs have seen substantial growth in recent years, reflecting an increasing recognition within the international community that CBRN materials falling outside regulatory control pose significant safety, security, and environmental risks. These issues have long been known but the adoption of UN Security Council Resolution (UNSCR) 1540 in 2004 has created greater global awareness of the risks.<sup>7</sup> Notably, UNSCR 1540 requires states to implement appropriate measures to ensure the security of 'nuclear, chemical or biological weapons', with specific provisions on physical protection, material accountancy and control, and border controls.<sup>8</sup> Thus implementing CBRN training is an obligation that all states should fulfill, and this extends to aligning their national regulation in the CBRN sphere to international legal provisions.

However, there remain obstacles to implementing such training, both due to the limited resources available and the need to educate a diverse and global-dispersed community of practitioners. Pedagogical methods that place the trainee or student at the center of the teaching process are known to induce a deeper understanding of the subject matter, and case studies are particularly effective in this endeavor. They also induce a storytelling quality, a mnemonic device that helps learners recall large amounts of information and for long durations. It is this 'deep learning' that imparts a more comprehensive and meaningful understanding of the subject matter.

The article is divided into three sections: the first discusses the theoretical underpinnings of the pedagogy for case studies; the second provides some practical information on teaching implementation; and the third

---

<sup>5</sup> Edwin C. Leonard Jr. and Roy A. Cook, "Teaching with Cases", *Journal of Teaching in Travel & Tourism*, 10(1) (March 2010), p. 96.

<sup>6</sup> Ellen Schall and Thomas Gilmore, "Staying Alive to Learning: Integrating Enactments with Case Teaching to Develop Leaders", *Journal of Policy, Analysis and Management* 15(3) (1996), pp. 444-456.

<sup>7</sup> Wyn Q. Bowen, Matthew Cottee, and Sarah Tzinieris, "Evolution of Global Nuclear Security Governance", in Christopher Hobbs, Sarah Tzinieris, and Sukesh Aghara, eds., *The Oxford Handbook of Nuclear Security* (Oxford: Oxford University Press, 2023).

<sup>8</sup> UN Security Council, Security Council Resolution 1540 (2004), April 28, 2004, S/RES/1540 (2004).

examines the limitations of case studies but argues these are possible to overcome with sufficient resources and planning. In writing this article, we, the authors, conducted a comprehensive literature review and revisited empirical findings from CBRN nonproliferation training that we delivered from King's College London. Ultimately, it was found that experiential teaching methods in general are preferable to traditional passive learning formats so long as the trainee is at the center of the teaching process. Moreover, although case studies are only one of several types of experiential teaching methods, they are the most expedient to achieve positive learning outcomes—especially when resources are limited. We argue however that the selection of case studies requires improvement to reduce bias. For too long, case studies have tended to reflect Western priorities and may not be easily relatable to non-Western audiences. We also emphasize that the utility of the case study approach comes down to how effectively they are curated within a broader curriculum as well as how well they are taught, which requires skillful facilitators who can cultivate a dynamic and engaging discussion.

### Case studies as a pedagogical tool

In recent decades, there has been a profound shift in the delivery of teaching within the higher education sector. Driven by a desire to improve the way in which students learn, education professionals have sought to develop teaching methods that induce 'deep learning', with the aim to impart a more comprehensive and meaningful understanding of the subject matter.<sup>9</sup> The pedagogy literature charts these new developments in teaching methods, sometimes differentiating between the traditional 'instruction paradigm' and the more recent 'learning paradigm', this distinction being first proposed by Robert Barr and John Tagg in 1995.<sup>10</sup> The instruction paradigm describes what was historically the dominant approach to teaching: a passive format whereby instructors, often subject matter experts, deliver a lecture to a large group of students in a one-way exchange of information. Students are expected to assimilate a significant amount of information, usually with a view to replicating this information, or parts of it, through an assessment process such as an end-of-course examination.<sup>11</sup>

---

<sup>9</sup> Jackie Lublin differentiates between 'deep', 'surface' and 'strategic' approaches to learning; see "Deep, Surface and Strategic Approaches to Learning", Centre for Teaching and Learning, University College Dublin, 2003.

<sup>10</sup> Robert B. Barr and John Tagg, "From Teaching to Learning: A New Paradigm for Undergraduate Education", *Change: The Magazine of Higher Learning*, Vol. 27, Issue 6 (1995).

<sup>11</sup> Christopher Hobbs and Matthew Moran, "Developing Educational Courses in Nuclear Security: A Handbook", King's College London, 2014.

## The nun who broke America's nuclear sanctum: the use of case studies in CBRN nonproliferation training

The learning paradigm, by contrast, places the student at the center of the teaching process. The aim is for students to derive a deeper understanding of the subject matter and develop critical thinking skills. The learning paradigm recognizes that a flexible combination of teaching methods, dependent on the specific subject matter, is an effective way to engage students. This approach also attaches significance to assessment and feedback throughout the period of learning, rather than the examination element being viewed as a standalone product at the end of a program.<sup>12</sup> Case studies complement the learning paradigm approach well through their emphasis on placing the student at the center of teaching to induce problem-solving and deep learning. Various scholars have shown that of all the classroom methods employed, the use of case studies is typically the most effective for developing critical-thinking skills.<sup>13</sup>

Case studies have been used in teaching for centuries. It is difficult to compose a precise history because it likely pre-dates the invention of writing. Epic tales such as *Gilgamesh* and the *Odyssey* were used to immerse audiences in a myriad of life lessons,<sup>14</sup> and ancient philosophers like Aristotle and Plato have acknowledged the value of narrative demonstrations.<sup>15</sup> Case studies as a formal teaching method, however, first appeared in American universities in the late nineteenth century.<sup>16</sup> In particular, the pioneering efforts of Dean Christopher Columbus Langdell of the Harvard Law School encouraged students training to become lawyers to interrogate and discuss previous legal cases. The objective was "to generalize particular decisions into broader understandings of the principles of law."<sup>17</sup>

Despite initial skepticism of Langdell's approach, the method gradually spread to other law schools in the US and then subsequently to other countries. Concurrently, the development of a new school focused on business was under discussion within the university: the modern-day Harvard Business School, which opened its doors in 1908. From the outset, its curriculum focused on practice and the instructional method

---

<sup>12</sup> Hobbs and Moran, "Developing Educational Courses in Nuclear Security".

<sup>13</sup> Beryl C. McEwen, "Teaching Critical Thinking Skills in Business Education", *Journal of Education for Business*, 70(2) (July 2010), pp. 99-103; Leonard and Cook, "Teaching with Cases", p. 96.

<sup>14</sup> Maria Tilk, "Educational Narratives as a Pedagogical Paradigm: the Epics of Homer", *Acta Paedagogica Vilnensia*, 32 (January 2014), pp. 44-58.

<sup>15</sup> Elizabeth Trott, "Philosophy as Storytelling", *Ultimate Reality and Meaning*, Vol. 35, Issue 3-4, (September -December 2012), pp. 190-203.

<sup>16</sup> Katherine K. Merseth, "The Early History of Case-Based Instruction: Insights for Teacher Education Today", *Journal of Teacher Education*, Vol. 42, Issue 4 (1991), p. 243.

<sup>17</sup> Merseth, "The Early History of Case-Based Instruction", p. 243.

was a case approach within classroom discussion. The Harvard case method has been so influential it can be understood as a whole sub-set of the field, with its emphasis on role-play and Socratic debate.<sup>18</sup>

Since then, case studies have been used in higher education for over 150 years—most widespread in the disciplines of law, business, and medicine.<sup>19</sup> In recent decades, educators from a variety of academic disciplines and other educational contexts have recognized their utility as a pedagogical tool, and case studies have been adapted for use not only in academia but in industry, including in sectors that deal with CBRN issues. As well as in teaching, the case study approach can be used in a research context, although in practice these mediums are interlinked. Case study research can be applied to conduct pilot research and even to develop new theories or refine existing ones.<sup>20</sup> In a research context, the utility of case studies comes from being able to test complex issues in real-life settings.

The academic literature on pedagogy employs various terms to describe the use of case studies in teaching: case study methodology, case study pedagogy, case study method, case study instruction, case discussion, or case reading.<sup>21</sup> Related fields also include the study of narrative and the study of memory. At its heart, the case study approach is about employing dynamic and innovative methods to engage students or trainees on a particular topic.<sup>22</sup> After all, the storytelling quality of many case studies acts as a mnemonic device that aids information retention and retrieval in the human memory for better understanding. Classic mnemonic devices are associated primarily with memorization (e.g., the alphabet song)—focusing on the cognitive process of remembering. However, the goal is always to help people encode, store, and make sense of information—resulting in meaning-making.

Memory is not only a function of the human brain; it also has a social dimension.<sup>23</sup> Key factors that contribute to the development of memory

---

<sup>18</sup> For more details on the HBS Case Method, see “The HBS Case Method”, Harvard Business School, accessed October 16, 2023, <https://www.hbs.edu/mba/academic-experience/Pages/the-hbs-case-method.aspx>.

<sup>19</sup> Tricia Mclam and Marianne Woodside, “Using Case Studies: An International Approach”, *International Education*, Vol. 34, n. 2, (2005), pp. 36-45.

<sup>20</sup> Johan Malmqvist et al., “Conducting the Pilot Study: A Neglected Part of the Research Process?” *International Journal of Qualitative Methods*, Vol. 18, no. 1 (2019).

<sup>21</sup> Sarah Gravett, Josef de Beer, Rika Odendaal-Kroon, and Katherine K. Merseth, “The affordances of case-based teaching for the professional learning of student-teachers”, *Journal of Curriculum Studies*, Vol. 49, No 3 (2017), p. 372.

<sup>22</sup> Vicki L. Golich, Mark Boyer, Patrice Franko, and Steve Lamy, “The ABCs of Case Teaching”, Institute for the Study of Diplomacy, Georgetown University, 2000, p. 32.

<sup>23</sup> Maurice Halbwachs, *On collective memory* (Chicago: Chicago University Press, 1992).

## The nun who broke America's nuclear sanctum: the use of case studies in CBRN nonproliferation training

are motivation, attention, and conscious decision-making.<sup>24</sup> In other words, you are unlikely to remember something you did not pay attention to and do not care about. One of the reasons that narratives, storytelling and, indeed, case studies are so effective in learning is that they are deeply rooted in culture, encompassing social behavior, institutions, and norms that people are familiar with.<sup>25</sup> Case studies almost inevitably link to beliefs, views, and values (in the instructor, the trainee, and the characters in the case itself). It is difficult not to remember Sister Megan—whether that is due to her sabotage, activism, faith, or even gender.

A criticism often levied at higher education is that it 'is too theoretical, or not sufficiently practice focused'.<sup>26</sup> Case studies present an alternative to more passive teaching formats such as speeches and lectures, where a speaker imparts information to others in a unilateral exchange. Case studies bring unique value by bridging the perceived gap in education between theory and practice, sometimes termed the 'theory-practice predicament'.<sup>27</sup> With this approach, students are expected to analyze a realistic situation, apply prior concepts, knowledge, or personal experiences, and then produce recommendations for actions or draw logical conclusions. Through the process, case studies help to ground theoretical concepts in practice through the application of critical thinking.<sup>28</sup>

Case studies also provide a context in which uncertainty and nuances can be probed—not dissimilar to the 'real world'—but with the advantage that poor judgments or flawed decisions have no real-world consequences.<sup>29</sup> They also give students practice in identifying the parameters of a problem, recognizing and articulating positions, evaluating courses of action, and arguing different points of view. Furthermore, case studies are often conducted in a group setting, thereby encouraging students to develop communication, interpersonal, and teamwork skills. Underscoring the importance of 'soft skills', the 2023 World Economic Forum report makes the point that despite the predicted expansion of

---

<sup>24</sup> Tommy Oaks, "Storytelling: A Natural Mnemonic. A Study of a Storytelling Method to Positively Influence Student Recall of Instruction", doctoral dissertation submitted to the University of Tennessee, Knoxville, 1995.

<sup>25</sup> Qi Wang, Qingfang Song, and Jessie Bee Kim Koh, "Culture, Memory, and Narrative Self-Making", *Imagination, Cognition and Personality*, Vol. 37, Issue 2 (2017), pp. 199-223.

<sup>26</sup> Gravett et al., "The affordances of case-based teaching", p. 369.

<sup>27</sup> Gravett et al., "The affordances of case-based teaching", p. 370.

<sup>28</sup> Merseeth, "The Early History of Case-Based Instruction", p. 379.

<sup>29</sup> Christopher Hobbs and Matthew Moran, "Insider Threats: An Educational Handbook of Nuclear & Non-Nuclear Case Studies", King's College London, 2015, <https://www.kcl.ac.uk/csss/assets/insider-threats-handbook.pdf>.

<sup>30</sup> Merseeth, "The Early History of Case-Based Instruction", p. 379.



automatic and artificial intelligence (AI) in the workplace, human skills like creativity, collaboration, empathy, and communication will continue to be highly valued by employers.<sup>30</sup>

Regarding their content, case studies vary widely but the pedagogical literature sometimes distinguishes between two types: 'retrospective' or 'narrative'; and 'decision-forcing'.<sup>31</sup> In a retrospective or narrative case study, a comprehensive description of events is presented, "complete with multiple actors, contending interests, and the *real* outcome."<sup>32</sup> Students are made aware of the sequence of events leading up to a final outcome and may be asked to determine if a 'better' solution was possible. For example, the entire account of Sister Megan and her accomplices infiltrating the Y-12 facility is told, and students are asked to reflect on this. In a 'decision-forcing' case study, the final outcome is not made available; rather, students are asked to identify and then assess the range of possible options to be actioned.<sup>33</sup> For example, students are told only about the infiltration of Y-12, but not of the guard force's response or any subsequent security policy changes. The latter type of case study confers a variety of benefits, depending on the point of 'deployment'.<sup>34</sup> Introduced at an early stage, a decision-making case study can stimulate creative thinking ahead of theoretical principles being introduced; at a later stage, such an approach can enable students to use their knowledge to deal with the complexities of real-world problems. In sum, there are multiple benefits of employing case studies as well as multiple ways of doing so, and it is useful to now consider ways in which they can be implemented in the context of CBRN training, so they have the greatest impact.

## Implementing the case approach in CBRN training

Training and development programs focused on the nonproliferation of CBRN materials and equipment have seen substantial growth in recent years, reflecting an increasing recognition by the international community of the substantial risks posed by CBRN proliferation. Despite the CBRN lexicon, the field is in fact extremely wide-ranging and covers aspects as diverse as chemical weapons attacks in Syria, the use of nuclear forensics to locate radiological materials out of regulatory control, and the anthrax attacks in the US following the events of 9/11. What is more, each of the

---

<sup>30</sup> "Future of Jobs Report 2023", World Economic Forum, May 2023, [https://www3.weforum.org/docs/WEF\\_Future\\_of\\_Jobs\\_2023.pdf](https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf).

<sup>31</sup> Hobbs and Moran, "Insider Threats".

<sup>32</sup> Golic et al., "The ABCs of Case Teaching", p. 1.

<sup>33</sup> Golic et al. "The ABCs of Case Teaching", p. 1.

<sup>34</sup> Geoffrey Chapman et al., "Security Culture: An Educational Handbook of Nuclear and Non-Nuclear Case Studies", King's College London, 2017.

## The nun who broke America's nuclear sanctum: the use of case studies in CBRN nonproliferation training

four aspects—chemical, biological, radiological, and nuclear—is governed by different national and international regulatory regimes, with separate legal bases and different sources of best practice information.

The CBRN concept has deep historical roots, with the use of unconventional agents to inflict harm and death documented as early as writing itself.<sup>35</sup> However, the salience of the CBRN security issue came to wider intentional notice following the 9/11 attacks. The notion that non-state actors could initiate mass casualty terrorist attacks prompted a wave of policy entrepreneurship to mitigate the threat of CBRN proliferation, including funding for the training of security and safety professionals. From an early stage, it was also recognized that threat reduction efforts would only be effective and sustainable if those implementing security measures understood the broader issues at stake—namely, the nature of the threat, the maintenance and testing of security systems, the critical importance of a strong security culture and the range of potential adversaries, especially the threats posed by 'insiders'. This section examines how the case study approach has begun to be implemented in training and teaching in the CBRN nonproliferation field. Here, it is argued that case studies are highly effective means to activate awareness and cognition of CBRN issues, and they can be further supplemented and enhanced with other training methods and interventions.

### *The training context*

The past few decades have seen a shift in approach within higher education and professional training from that of passive instruction to active learning. Here, studies from a wide variety of fields have demonstrated the benefits of experiential and more flexible learning where students are placed at the center of the teaching environment.<sup>36</sup> This approach offers students the freedom to engage deeply with a subject, develop their own critical thinking skills, and apply these to complex problems. It also recognizes that students will have different preferred learning styles.<sup>37</sup> Consequently, applying a variety of teaching

---

<sup>35</sup> Zenobia S. Homan, "Unconventional Warfare in the Ancient Near East", *Social Sciences & Humanities Open*, Vol. 8, Issue 1 (2023).

<sup>36</sup> Robert B. Barr and John Tagg, "From Teaching to Learning: A new Paradigm for Undergraduate Education", *Change: The Magazine of Higher Learning* 27, no 16 (1995), p. 13.

<sup>37</sup> Neil D. Fleming and Colleen Mills, "Not Another Inventory, Rather a Catalyst for Reflection", *Professional and Organizational Development Network in Higher Education*, 1992, p. 137.

methods and catering to the different learning styles within a group can serve to motivate students and encourage deeper learning.

Training and development have taken a variety of forms. A popular format for industry personnel working in the CBRN field has been the use of workshops, focused on training early- and mid-career professionals. Workshops are designed to complement states' existing efforts to improve the protection of CBRN materials and equipment. The flexible approach enables instructors to showcase best practice guidance, share experiences in implementing other CBRN-related programs, and consider lessons learned, in addition to employing case studies. The workshop format tends to employ subject matter experts (SMEs) to disseminate information in a focused, educational environment. Trainers adapt the case studies they select to their audience. For example, in a workshop focusing on insider threats, they might use the case of Rodney Wilkinson's infiltration of Koeberg's Nuclear Power Plant; while working as a laborer on the plant's construction, Wilkinson planted four bombs to protest apartheid.<sup>38</sup> Nevertheless, the case study does not need to have an explicit CBRN dimension to have the desired impact, just as long as it is specific to the issue area being taught. As an example, cases from aviation can equally reveal important insights on countering insider threats. The case of the German Wings murder-suicide crash can be used to broadly address the issue of unfitness for work in any organizational structure.<sup>39</sup>

Developing CBRN nonproliferation training for an international audience is not a simple endeavor. There exist significant complexities in terms of stakeholders, national contexts, regulatory systems, and the operating environments in which CBRN materials are employed. One of the challenges is conveying the criticality of this undertaking to governments and other key international stakeholders when historically nuclear security and chemical security—but not radiological security or biological security—have been perceived as more salient. To be effective, training also needs to focus on reaching participants of diverse organizational and cultural backgrounds. To this end, trainers around the world are now making an effort to diversify CBRN case study materials. Where previously they heavily relied on cases drawn from the US, owing to the dominance of the Harvard case method and others, but which may not

---

<sup>38</sup> Jo-Ansie van Wyk, "Nuclear terrorism in Africa: The ANC's Operation Mac and the attack on the Koeberg Nuclear Power Station in South Africa", *Historia* 60, no 2 (2015).

<sup>39</sup> Geoffrey Chapman et al., "Radicalisation and Preventative Measures: An Educational Handbook of Insider Threat Case Studies", CSSS Occasional Paper Series, King's College London, 2018, [https://kclpure.kcl.ac.uk/portal/files/124516397/Radicalisation\\_Preventative\\_Measures\\_Handbook.pdf](https://kclpure.kcl.ac.uk/portal/files/124516397/Radicalisation_Preventative_Measures_Handbook.pdf).

always be relatable, cases are now being assembled that draw from other regions.<sup>40</sup> For example, King's College London recently released a case study handbook authored by researchers from India and Pakistan that explores nuclear and radiological security in a specifically South Asian context.<sup>41</sup> This includes case studies that relate specifically to the milieu, including the agricultural sector in this region, nuclear medicine facilities, the development of new cyber security policies, and the impact of political misinformation on nuclear security.

Recognizing these challenges, it is argued that the theoretical concepts of CBRN nonproliferation education can be most effectively disseminated through pedagogical tools that both encourage interaction between instructors and trainees, and ground concepts in the real-world situations of the trainees themselves. The overarching training environment should also be designed with the recognition that trainees may hail from a wide variety of backgrounds—national, academic, and vocational. Where possible, the material should be relevant and applicable to—just to use hypothetical examples—a worker from an oil company operating in Nigeria engaged in well logging, a cancer nurse in Italy using radiotherapy, or a university researcher working with biohazardous materials in India. Consequently, the curriculum should employ an interdisciplinary approach to ensure that wide-ranging contexts are covered. It is also crucial that learning materials are shaped by international guidance—such as that produced by the International Atomic Energy Agency (IAEA) and the Organisation for the Prohibition of Chemical Weapons (OPCW)—as well as other sources of international best practices. In sum, case studies are most likely to be effective when cases are tailored to a trainee's context, although a flexible approach is necessarily required when dealing with a diverse audience (such as in an international workshop setting).

### *Case studies in a workshop setting*

The workshop format makes an obvious pairing with the use of case studies, which are now widely recognized as an effective way to link theory with practice and to develop critical thinking skills.<sup>42</sup> Here, real-life case studies involving the proliferation of CBRN materials and devices

---

<sup>40</sup> To put this in context, Harvard Business School earned US\$16.7 million from selling case studies in 2022; see Harvard Business School, 2023, 2022 Annual Report, 24, <https://www.hbs.edu/about/annualreport/2022/HBS-Annual-2022.pdf>.

<sup>41</sup> Zenobia Homan and Amelie Stoetzel, eds., "Exploring nuclear and radiological security in South Asia: A case study handbook", CSSS Occasional Paper Series, King's College London, 2022, <https://www.kcl.ac.uk/csss/assets/exploring-nuclear-radiological-security-south-asia.pdf>.

<sup>42</sup> McEwen, "Teaching Critical Thinking Skills in Business Education", p. 96.

can be presented in a 'retrospective' manner with trainees tasked with assessing the motivations and actions of the 'adversary', before identifying the facility's security failings.<sup>43</sup> Trainees might also be encouraged to consider broader lessons from particular cases and transpose them into their own organizational contexts. For example, the case of Sister Megan is relevant to CBRN training in terms of what it tells us about security culture. As such, a trainer might ask, "Why do you think the first responder acted in the way they did?", "What does this case tell us about the importance—and difficulties—of managing and motivating a guard force?", and "What does it tell us about the importance of the human factor in the design, operation, and maintenance of physical protection systems?".

To explore the practical implementation of CBRN nonproliferation measures across various organizational environments, the pedagogical methods employed should be designed to engender active participation and the sharing of experiences. This is especially effective when the workshop participants consist of practitioners hailing from different organizational backgrounds (such as from across government, regulatory bodies, operators, and so on<sup>44</sup>). Tapping into this source will enable trainees to offer unique viewpoints as well as considerable practical experience. A flexible approach to the use of case studies enables a skilled instructor to pursue such opportunities, as well as leverage from "teachable moments" that can emerge through classroom discussion.<sup>45</sup> The aim here is to guide trainees towards mutual discovery and enable learning on multiple levels. The collaborative nature of working in groups to interrogate case studies creates a more relaxed environment and this can stimulate greater reflection and self-observation.<sup>46</sup>

Despite the obvious benefits of flexible and experiential learning, however, the more traditional lecture format (i.e., the instruction paradigm) may remain relevant to some aspects of a CBRN nonproliferation workshop. This format—involving an SME speaking to a group in a unilateral exchange—is an effective method when there is a requirement to transmit

---

<sup>43</sup> King's College London has developed a number of case study handbooks for integration into education and training programs; see <https://www.kcl.ac.uk/csss/training>.

<sup>44</sup> This is the typical diverse makeup of trainees in the CBRN workshops delivered by King's College London.

<sup>45</sup> "Teaching by the Case Method: Case Method in Practice", Christensen Center for Teaching & Learning, Harvard Business School, accessed October 16, 2023, <https://www.hbs.edu/teaching/case-method/Pages/default.aspx#:~:text=Chris%20Christensen%20described%20case%20method,real%2Dworld%20problems%20and%20challenges>.

<sup>46</sup> "Teaching by the Case Method", Christensen Center for Teaching & Learning.

a significant amount of information in a short period of time. Here, lectures can be used largely to convey key concepts rather than to focus on the implementation of measures. There may be a role for the instruction paradigm even in a workshop setting, for instance, to set out high-level concepts when a topic is first introduced to trainees in a large group setting before instructors then switch to the learning paradigm. Understanding how these formats can be used in complementary ways reflects a skillful curation of the curriculum.

### *Ensuring sustainable outcomes*

The issue of sustainability and long-term impact is critical in any educational or training activity. Given the technical nature of CBRN nonproliferation training, there is an intrinsic challenge in ensuring that trainee knowledge and experiences gained from workshop attendance are translated into improved practice. It is worth mentioning that sustainable outcomes are relevant to both the individual and their organization, and such an approach can help address challenges like high staff turnover which leads to the need for repeated training. In fact, sustainable outcomes can even extend to the national and regional levels due to the process of knowledge diffusion. A pertinent example of the latter is how the Black Sea Women in Nuclear Network (BSWN) was formed by a group of women from Bulgaria, Georgia, Moldova, Romania, Turkiye, and Ukraine in Odessa in 2021, with its first official meeting held in Malta in 2022. The BSWN's work has spread regionally and has even played a role in keeping nuclear and radiological materials safer in Ukraine following Russia's invasion.

A number of steps can be taken to facilitate sustainable outcomes, such as the production of a workshop handbook with session summaries and further reading so that trainees can continue to expand their learning beyond the workshop. A particularly effective way to ensure sustainability is encouraging trainees to run internal training courses in their host institutions: a 'train the trainer' approach. This involves trainees utilizing and expanding on the materials presented in a workshop, including in ways that suit their own organizational contexts.

A study conducted at King's College London in the nuclear security field has charted how such an approach can lead to a shift from an academic 'community of interest' to a 'community of practice'.<sup>47</sup> This involves facilitating a transition from communities where educators 'share little

---

<sup>47</sup> Matthew Moran and Christopher Hobbs, "From Communities of Interest to Communities of Practice: The Role and Impact of Professional Development in Nuclear Security Education", *British Journal of Educational Studies* 66, no1 (2018), pp. 87-107.

more than a passing awareness' to sustainable communities 'characterized by a shared repertoire of resources, approaches, and frameworks of action.'<sup>48</sup> Thus the aim of such training should be to equip trainees with the appropriate educational resources to foster their own 'communities of practice' on CBRN security which are sustainable but also suited to the specific cultural, national, and organizational context. Indeed, it might even be argued that a successful 'train the trainer' program will eventually become obsolete because the learnings are diffused sufficiently amongst the relevant communities of practice.

Perhaps inevitable with the development of a new curriculum, workshops, and case study sessions may encounter challenges in both design and implementation. As such, a structured post-evaluation process and emphasis on 'lessons learned' can serve to enhance future iterations of the training. Indeed, it is important to create a culture in CBRN nonproliferation training that emphasizes continuous progress and improvement. Evaluation can take the form of both formal and informal feedback. Key questions that should be covered include "Are the principal learning objectives achieved?" and "Are trainees stimulated to think beyond this case and develop insights through linkages across sessions and courses?" This can be investigated by considering the level of engagement and participation, management of the discussion, clarity and balance of the materials, feedback on timing and difficulty, and so forth.<sup>49</sup> It is important for the training organization to maintain a 'lessons learned' document that can inform future instructors as well as case study authors.

### *Security and organizational culture*

Although CBRN safety and security principles are relatively straightforward to outline and articulate, achieving effective security is a complex endeavor. It is also one that varies from country to country as a result of differences in legal and regulatory structures, the threat environment, resource constraints, and political priorities. The importance of achieving a robust security culture in the CBRN context cannot be underestimated given that radioactive sources and chemicals are frequently used either in environments that are 'customer-facing' (such as universities and hospitals) or in industries where radiological sources and chemicals are mobile. As a result, the physical security of settings is often limited for operational or practical reasons. A strong security culture—

---

<sup>48</sup> Moran and Hobbs, "From Communities of Interest to Communities of Practice", p. 90.

<sup>49</sup> "In-Class Assessment of Discussion-Based Teaching", Christensen Center for Teaching & Learning, Harvard Business School, accessed October 16, 2023, <https://www.hbs.edu/teaching/Documents/In-Class-Assessment.pdf>.

## The nun who broke America's nuclear sanctum: the use of case studies in CBRN nonproliferation training

whether through the development of human resources or employees' individual actions—is essential in ensuring the security of CBRN materials and equipment. The case study approach, by drawing on practical examples has particular resonance here to inculcate the less tangible concept of security culture. For example, case studies that have explored the 'normalization of deviance' concept—such as in the Deepwater Horizon oil spill and Space Shuttle Challenger explosion—can be used to explain how disasters are often the result of human error.<sup>50</sup>

Meanwhile, there is growing recognition that academic and research environments pose particular vulnerabilities in the CBRN dimension.<sup>51</sup> Around the world there are huge numbers of institutions housing hazardous CBRN materials for research purposes, ranging from biological and chemical agents to HASS sources and nuclear research reactors. These institutions face the perennial tension between, on the one hand, implementing CBRN controls to protect the wider community from non-state actors seeking to procure such materials for nefarious purposes, and, on the other, ensuring academic freedoms to facilitate independent and original research. A related risk is the theft of technology and sensitive information from universities and research institutions by non-aligned states seeking to enhance their military capabilities and by proliferator states pursuing WMD programs.<sup>52</sup> A key takeaway for CBRN education and training is that the locus of risk and vulnerability in the CBRN dimension may not be obvious—and trainers need to be cognizant of evolving security trends. CBRN case studies, such as those developed by King's College looking at the academic and research environment, can be valuable as a means of characterizing the multifaceted and nuanced nature of CBRN security issues.<sup>53</sup> Another takeaway is that while the need for protection may seem obvious and irrefutable, in reality those working with CBRN materials on the 'coalface' may in fact be under pressure to

---

<sup>50</sup> The 'normalization of deviance' concept was first coined by sociologist Diane Vaughan; see *The Challenger Launch Decision: Risk Technology, Culture and Deviance at NASA*, (Chicago: University of Chicago Press, 1996).

<sup>51</sup> Jinho Chung et al., "Nuclear Security within Academic and Research Organisations: A Handbook of Global Case Studies", CSSS Occasional Paper Series, King's College London, March 25, 2022, [https://kclpure.kcl.ac.uk/ws/portalfiles/portal/170404255/NS\\_in\\_Academic\\_and\\_Research\\_Organisations.pdf](https://kclpure.kcl.ac.uk/ws/portalfiles/portal/170404255/NS_in_Academic_and_Research_Organisations.pdf).

<sup>52</sup> Emma Scott, Ross Peel, Felix Ruechardt, and Nick Mitchell, "Catalogue of Case Studies on Intangible Technology Transfers from Universities and Research Institutes", CSSS Occasional Paper Series, King's College London, September 2020, <https://www.kcl.ac.uk/csss/assets/itt-case-studies-2020.pdf>.

<sup>53</sup> See Scott et al., "Catalogue of Case Studies on Intangible Technology Transfers from Universities and Research Institutes" and Chung et al., "Nuclear Security within Academic and Research Organisations".



balance multiple and competing interests (in the education sector, for instance, protection needs to be offset against academic freedom).

### *Online and hybrid delivery formats*

In the past two decades, online tools such as the IAEA's nuclear security e-learning platform have represented valuable resources for disseminating information to individuals working with CBRN materials around the world.<sup>54</sup> The digitalization of training saw a huge uptick with the Covid-19 pandemic, leading to significant innovation in the delivery methods for CBRN training. However, early on in the pandemic, training was an area of business operations that was often significantly undermined, being regarded as less important given the imperatives of saving lives. As a result, many organizations initially canceled or delayed training.<sup>55</sup> Nevertheless, most such organizations subsequently found ways to transition to alternative modes of delivery, particularly through the development of digital platforms. Since the pandemic, the use of digital platforms has proliferated, with organizations recognizing the beneficial impacts of reaching larger audiences and working across multiple geographies.

Many aspects of CBRN nonproliferation are set to continue being delivered by either digital platforms or hybrid formats (a combination of digital and in-person) in the longer term.<sup>56</sup> Case studies are particularly suited to the digital approach due to their ability to motivate, captivate, and engage. Nevertheless, despite online and hybrid delivery formats facilitating greater inclusion in CBRN training programs, there are still many communities globally that do not have access (or stable access) to the internet, particularly in sub-Saharan Africa.<sup>57</sup> As such, online delivery formats are not necessarily a panacea to the deep structural inequalities that continue to block access to training for some communities. Furthermore, in many cases, online training can never fully replicate in-

---

<sup>54</sup> The IAEA has developed e-learning courses on a broad range of nuclear security topics (in all official languages), with the objective to develop human resources around the world; see <http://elearning.iaea.org>.

<sup>55</sup> Sarah Tzinieris, Christopher Hobbs, and George Foster, "Lessons for Nuclear Security from the UK's Response to Covid-19", CSSS Occasional Paper Series, King's College London, 2022, [https://kclpure.kcl.ac.uk/ws/portalfiles/portal/218970353/Lessons\\_for\\_Nuclear\\_Security\\_from\\_the\\_UK\\_s\\_Response\\_to\\_Covid\\_19.pdf](https://kclpure.kcl.ac.uk/ws/portalfiles/portal/218970353/Lessons_for_Nuclear_Security_from_the_UK_s_Response_to_Covid_19.pdf).

<sup>56</sup> Tzinieris et al., "Lessons for Nuclear Security from the UK's Response to Covid-19".

<sup>57</sup> Charlie Muller and João Paulo de Vasconcelos Aguiar, "What Is the Digital Divide?" Internet Society, 2022, <https://www.internetsociety.org/blog/2022/03/what-is-the-digital-divide>.

person training, especially in cases where the involvement of physical materials or physical locations is integral to the learning outcomes.

### *Supplementing the case approach*

#### *Tabletop exercise*

CBRN nonproliferation programs can make significant use of real-life case studies through a tabletop exercise based on a hypothetical CBRN facility. In a typical tabletop exercise, trainees are organized into groups of between three and six people to work on a hypothetical scenario although this should be realistic and relatable to the trainees. Within their teams, trainees navigate scenarios such as a hypothetical medical facility containing several high-activity radioactive sources, with information provided to trainees on the perceived threat and current security system and practices in place. Trainees working in small groups might be asked to put themselves in the mind of the adversary and consider how successful attacks against the facility could be perpetrated. This is a commonly utilized approach known as 'red teaming' where an assembled group simulates an attack on the target organization.<sup>58</sup>

In this context, trainees can be asked to construct realistic attack pathways as a means of highlighting the weaknesses within the facility security system. The task might then evolve into an assessment of cost-effective security solutions. At all times, trainees should be encouraged to consider an intelligent adversary that represents a dynamic and ever-changing threat—requiring an approach capable of being modified in response to changes in security.<sup>59</sup> One of the benefits of tabletop exercises is that they can be used for testing action plans and operational procedures at specific facilities. In the nuclear security field, training frequently makes use of a hypothetical nuclear facility called Shapash, developed by the IAEA.<sup>60</sup> The UN Interregional Crime and Justice Research Institute (UNICRI) is an example of an organization that utilizes tabletop exercises to full effect, with an emphasis on deploying a practical approach in its security training.<sup>61</sup>

---

<sup>58</sup> For a full discussion of 'red teaming' see BSI Group, 2023, "What is red teaming and what are the benefits to my business", <https://www.bsigroup.com/en-GB/blog/Digital-trust-blog/what-is-red-teaming>.

<sup>59</sup> M. Kenney, "From Pablo to Osama: Counter-Terrorism Lessons from the War on Drugs", *Survival* 45 (2003), pp. 187-206.

<sup>60</sup> "Step into the World of Nuclear Security Training – Online, Mobile and in 3-D", News, IAEA, 2017, <https://www.iaea.org/newscenter/news/step-into-the-world-of-nuclear-security-training-online-mobile-and-in-3-d>.

<sup>61</sup> "Training and Advanced Education", UNICRI, 2024, [https://unicri.it/services/education\\_training/postgraduate](https://unicri.it/services/education_training/postgraduate).

### *Through-course project*

A through-course project (TCP) is similar to a tabletop exercise, but here the activity is conducted over several sessions (usually over several days). Each task that is set builds on the previous one and new information is revealed at each stage. The advantage of this is twofold: i) the trainees accumulate knowledge as they go along, so they are not overwhelmed with information and can remain focused; ii) each new task mirrors the curriculum from the training session delivered previously, thereby cementing the learning session-by-session or day-by-day. A TCP might culminate in a special session at the end, such as group presentations in front of the wider classroom with instructors also taking part (e.g., they might play the role of a governing board or regulator).

The simulation format—utilized in case study sessions, tabletop exercises, and TCPs—enables the trainees to engage with the subject matter in a more focused way than might be the case with traditional teaching formats such as lectures. In particular, the simulation format ‘brings to life’ the complexities of real-world problems and encourages new thinking and creativity on finding solutions to CBRN problems. This is especially useful for helping trainees to engage with the more intangible topic of security culture. Indeed, the simulation format is particularly relevant to CBRN materials where security rests far less with ‘guns, guards, and gates’ than the personnel responsible for their protection.

### *Polling and questionnaires*

Employing polling and questionnaires during training is another way to maximize the interactive learning format. Electronic voting systems allow instructors to pose questions during a training session, enabling trainees to express their views on issues of importance. Trainees click on handheld devices, centrally connected to the instructor. The speaker waits until all responses are collected (usually no more than a few minutes), then pulls them into a graph displayed automatically in their presentation slide pack. The results can be used to generate a classroom discussion to probe the answers.

In addition to the fruitful classroom discussion, this format provides instructors with real-time information on participant understanding so any areas of confusion can be clarified. Another benefit is trainees have the freedom to participate anonymously; but equally those who feel comfortable in sharing their views publicly can do so during the follow-up discussion. Since the Covid-19 pandemic, there are a number of companies now offering polling and questionnaire formats on mobile phone apps.

### *Site visit*

A site visit can be an extremely valuable aspect of a training course as it goes to the heart of experiential learning. In the CBRN context, it might involve a trip to a facility where some of the education from the course can be seen from the industry and practitioner perspective. Importantly, this experience taps into the memory aspect that is essential for deep learning. Case studies can even be used in tandem with the site visit to maximize learning opportunities here. For instance, a visit to a biological laboratory could be supplemented by the dual-use case studies made available by the Federation of American Scientists on its Biological Research platform.<sup>62</sup> However, disadvantages of site visits include the cost, resources, and time involved. Still, it is sometimes possible to make use of local visits that, while more limited, can still bring a lot of value to trainees.

### Limitations of the case approach in CBRN training

Despite the many advantages conferred by case studies, the approach inevitably has its limitations and is still mostly used in conjunction with more traditional pedagogical formats such as lectures. While case studies are highly valuable teaching methods, they do not fully replace the necessary provision of onsite training. The nature of many CBRN materials is that they sometimes can be somewhat inaccessible; for instance, in the case of radiological sources, there are patient confidentiality issues in hospitals and it is difficult logistically to visit oil and gas drilling rigs. As such, the development of alternative learning tools for workshops—particularly the simulation format—takes on even greater relevance. Here follows a discussion of the limitations of case studies, but also actions that can be taken to mitigate these.

### *Challenges in teaching case studies*

Most obviously, case studies place pressure on instructors who often need to spend a considerable amount of time planning and developing the materials. Even with appropriate preparation, 'the outcome of the exercise is not necessarily fixed'.<sup>63</sup> Instructors may be faced with not only unexpected questions but also with students making unanticipated decisions about a particular case. Ensuring that the case study remains aligned with the objectives of the broader learning goals remains a

---

<sup>62</sup> See Federation of American Scientists, "Case Studies in Dual Use Biological Research", accessed October 16, 2023, <https://biosecurity.fas.org/education/dualuse/index.html>.

<sup>63</sup> Chapman et al., "Security Culture".

constant challenge.<sup>64</sup> It is worth noting that with the growing global interest in the use of case studies in teaching, a market has now developed in this area, which, as mentioned, remains dominated by American-authored cases<sup>65</sup>— although the landscape is starting to shift.

Ultimately, the strength of the case study approach comes down to the quality of the teaching, requiring skillful facilitators who can cultivate a dynamic and engaging discussion. To be effective, the activity requires not only a relevant, topical, and nuanced case study, but also a skillful facilitator who can guide cultivate a dynamic and engaging group discussion. Case studies remain popular with students, with evidence showing that instructors employing this format rank consistently highly on satisfaction surveys.<sup>66</sup> Yet, it is important to note that the engagement of students or trainees is in part related to the enthusiasm with which instructors embrace case studies as a pedagogical tool.

Instructors are also required to take on the role of facilitator in running a case study exercise, thereby losing their status as the provider of answers.<sup>67</sup> This unfamiliar dynamic can help invigorate a classroom setting, but it can also unnerve students.<sup>68</sup> For this reason, there is a risk that instructors can, albeit unintentionally, guide trainees to solutions that ‘confirm the validity of concepts being taught’ rather than employing case studies to generate an open-ended discussion.<sup>69</sup> It is therefore recommended that instructors accept a degree of flexibility in the classroom, at the same time as being prepared to manage potential dissent.

Case method teaching has been described as ‘the art of managing uncertainty—a process in which the instructor serves as a planner, host, moderator, devil’s advocate, fellow student, and judge.’<sup>70</sup> That is a lot of skills for an instructor to possess or learn. It requires a good understanding of participant-centered learning, leadership presence, interpersonal skills, and where possible some form of teacher training.<sup>71</sup> On top of this, the learning environment has to be given careful

---

<sup>64</sup> Hobbs and Moran, “Insider Threats”.

<sup>65</sup> As mentioned, Harvard Business School earned US\$16.7 million from selling case studies in 2022; see 2022 Annual Report, p. 24.

<sup>66</sup> Leonard and Cook, “Teaching with Cases”, p. 96.

<sup>67</sup> S.W. Henson, P.A. Kennett, and K.N. Kennedy, “Web-based cases in strategic marketing”, *Journal of Marketing Education*, Vol 25, Issue 3 (2003), pp. 250-259.

<sup>68</sup> Chapman et al., “Security Culture”.

<sup>69</sup> Larry E. Greiner, Arvind Bhambri and Thomas G. Cummings, “Searching for a Strategy to Teach Strategy”, *Academy of Management, Learning and Education* 2, n 4 (2017).

<sup>70</sup> “Teaching by the Case Method”, Christensen Center for Teaching & Learning.

<sup>71</sup> Joseph Lowman, *Mastering the Techniques of Teaching* (San Francisco: Jossey-Bass Publishers, 1984).

consideration. In various cultures, it is not deemed appropriate to question materials or instructors, and some trainees may be unfamiliar with case studies and case method learning. If these challenges are not taken into account and addressed, then the impact of the case study will be diminished.

### *Diversity issues*

Another limitation of the case study approach is that scenarios are still too often based on large-scale, corporate organizations in the West. For too long case studies have tended to reflect Western priorities and may not be easily relatable to non-Western audiences. For many students and trainees, the case studies they are provided are simply not relevant to their own experiences or future career aspirations.<sup>72</sup> Women leaders, for example, are still insufficiently represented in case studies, while the value of other perspectives, such as those of labor unions, may be underestimated.<sup>73</sup> For this reason, higher education institutions in other parts of the world are increasingly developing their own case studies—with the aim of making these more relevant and practical to their students.<sup>74</sup>

Another drawback is case studies may not fully reflect real-world situations, as these tend to evolve with information coming to light over a period of time. Case studies, by contrast, usually pre-assemble all the essential facts<sup>75</sup>—enabling students to evaluate a far wider range of options and pathways at any one time. One way to mitigate this particular issue is preparing case study materials that depict an evolving narrative, with new information provided at several points during the activity. As such, instructors should think carefully about the set of case studies they will utilize in their training.

A case study challenge unique to the CBRN arena is the fact that many incidents simply will never be publicly shared. No government or facility likes to admit to its mistakes. Crucially, many *cannot* admit to mistakes, because it could pose a security risk. For instance, explaining that a fence

---

<sup>72</sup> Howard Forman, “Participative Case Studies: Integrating Case Writing and a Traditional Case Study Approach in a Marketing Context”, *Journal of Marketing Education* 28, (2006,), pp. 106-113.

<sup>73</sup> Andrew Jack, “Why Harvard’s case studies are under fire”, *Financial Times*, October 29, 2018, <https://www.ft.com/content/0b1aeb22-d765-11e8-a854-33d6f82e62f8>.

<sup>74</sup> Jack, “Why Harvard’s case studies are under fire”.

<sup>75</sup> Ellen J. Kennedy, Leigh Lawton, and Erika Walker, “The Case for Using Live Cases: Shifting the Paradigm in Marketing Education”, *Journal of Marketing Education* 23, no 2 (2001), pp. 145-151.

could not be repaired due to insufficient funds could lead adversaries to monitor that area for further vulnerabilities. One way to mitigate this issue is to develop case studies that focus on good practices. For example, there is a case of a South African organization that was able to capitalize on grassroots initiatives to strengthen nuclear as well as chemical security.<sup>76</sup> In fact a number of organizations have produced good practice materials<sup>77</sup>—while scholars like Matthew Bunn and Scott Sagan have focused on ‘worst practices’ in order to emphasize the importance of actually *learning* from lessons learned.<sup>78</sup> Likewise tabletop exercises can be utilized to focus on good practices.

### *Resourcing constraints*

A broader challenge for training in the area of CBRN nonproliferation is to ensure that sufficient resources are devoted to the endeavor. In recent years, education and training specifically in the area of CBRN nonproliferation have been recognized by the IAEA, the OPCW, and national governments alike as vitally important in view of the vast numbers of incidents of CBRN proliferation that has taken place historically, especially in the context of often lax and uneven regulatory frameworks. While many national governments have been increasing resources in this area, one of the perennial challenges is that funding cannot keep pace with growing global demand.

A related issue is that much of the funding available for CBRN nonproliferation training tends to support activities related to nuclear materials (often civil nuclear sites), based on the belief that these represent a more attractive target than other CBRN materials for a potential adversary. Faced with scarce resources, ensuring that training for other aspects of the CBRN nexus induces sustainable outcomes in trainees’ home countries is a priority and requires support from governments, corporations, and other key stakeholders around the world. However, this raises another question on how to measure these

---

<sup>76</sup> Jinho Chung et al., “Nuclear Security within Academic and Research Organisations: A Handbook of Global Case Studies”, CSSS Occasional Paper Series, King's College London, 2022, [https://kclpure.kcl.ac.uk/portal/files/170404255/NS\\_in\\_Academic\\_and\\_Research\\_Organisations.pdf](https://kclpure.kcl.ac.uk/portal/files/170404255/NS_in_Academic_and_Research_Organisations.pdf).

<sup>77</sup> See for instance the publication of European Nuclear Security Regulators Association (ENSRA), “A Compendium of good practices for the inspection of security of nuclear materials and facilities”, 2021, <https://www.ensra.org/wp-content/uploads/2021/08/ENSRA-REPORT-2021-compendium-good-practices-nuclear-security-inspections.pdf>.

<sup>78</sup> Matthew Bunn and Scott D. Sagan, *A Worst Practices Guide to Insider Threats: Lessons from Past Mistakes* (Cambridge, MA: American Academy of Arts and Scientists, 2014).

sustainable outcomes. Whilst feedback collected during workshops is often resoundingly positive, it is more difficult to assess the tangible impacts of the workshops over the longer term.<sup>79</sup>

This all suggests that the private sector will need to play a larger role in CBRN training. While this area is 'arguably still viewed by many within the industry as rules and regulations to be followed, and often as a burden, rather than as a key organizational goal', scholars have drawn attention to how security might be reframed as a 'business enabler' through changing organizational beliefs and attitudes.<sup>80</sup> CBRN weaknesses can have long-term cost implications—not only financial, environmental, and legal, but also reputational and societal—and articulating the value of security is a society-wide imperative, not only the responsibility of states and operators. Another benefit of having the private sector involved in CBRN nonproliferation training is that it can also bring to bear its experience in risk mitigation.

### *Growing threat from mis- and dis-information*

A discussion of the limitations of the case studies approach would not be complete without acknowledging that not all materials relevant to CBRN training are valid or, indeed, grounded in fact; this includes case studies that instructors might find from an online search. This is particularly true in a time of mis- and dis-information, with campaigns and spurious information peddled by various non-state and state actors for political or financial gain and amplified across social media. For example, there is evidence that in the context of the Russian invasion of Ukraine, the Russian government has waged a biological weapons disinformation campaign accusing the Ukrainian authorities of secretly working with pathogens of dangerous infections, with American support.<sup>81</sup> Such mis- and dis-information campaigns are likely to target organizations and states deemed most vulnerable. Instructors can seek to mitigate this risk by, firstly, ensuring that the selected training materials derive from legitimate sources (for instance the IAEA in the case of nuclear security training), and, secondly, that trainees are made aware of such risks and are equipped with the skills necessary to identify legitimate information and conduct fact-checks.

---

<sup>79</sup> The statement that feedback collected during workshops is often resoundingly positive is based on the authors' experience of developing such workshops.

<sup>80</sup> Karl Dewey et al., "Reconceptualising Nuclear Security as a Business Enabler", paper presented at the IAEA International Conference on Nuclear Security, 1, 2020, [https://kclpure.kcl.ac.uk/ws/portalfiles/portal/170357050/IAEA\\_CN\\_278.pdf](https://kclpure.kcl.ac.uk/ws/portalfiles/portal/170357050/IAEA_CN_278.pdf).

<sup>81</sup> "Ukraine war: Fact-checking Russia's biological weapons claims", *BBC*, March 15, 2022, <https://www.bbc.co.uk/news/60711705>.



## Conclusion

Despite ongoing efforts to strengthen the nonproliferation of CBRN materials and equipment, a number of challenges remain at the local level. While the case of Sister Megan is unique and unlikely to repeat itself, the threat of a combination of small human security culture failures remains ever present at facilities across the world. The development of training that utilizes case studies is just one activity within global endeavors, aimed at strengthening security within a diverse range of operating environments. As evidenced by academic studies, the learning-centered approach with a focus on active participant engagement is most effective in fostering deep learning. Other forms of interactive teaching methods—including group discussions, tabletop exercises, and electronic voting—also help disseminate key concepts and support the sharing of international best practices.

There remains much work to be done to support training in the area of CBRN nonproliferation. This involves more concerted efforts by national governments, corporations, and other key stakeholders to promote wider CBRN security—not only nuclear security—as well as provide the associated funding. Organizations such as universities, professional societies, and online networks constitute instrumental actors in these endeavors—directing bottom-up pressures on governments and agencies, as well as diffusing information and educational resources within their circles of influence. There are already signs that informal communities of interest in the CBRN field are evolving into more structured communities of practice.

In view of the limited funding available, the objective should be to ensure sustainable outcomes through using low-cost resources such as case studies, as well as equipping practitioners with sufficient resources to disseminate their own education and training activities at their home organization. Overall, the benefits of the case study approach outweigh the challenges and limitations, though they are likely to remain part of a broader set of varied teaching formats. Meanwhile, the speed of technological innovation means that a number of skilled and technical roles will be gradually replaced by machines in the coming decades. The development of 'soft skills' such as critical thinking, problem-solving, and interpersonal abilities will be increasingly valued in the employees of the future.