

### III. Multilateral nuclear arms control, disarmament and non-proliferation treaties and initiatives

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Multilateral nuclear arms control, disarmament and non-proliferation efforts take place in a number of forums. These include formal negotiating forums such as the Conference on Disarmament (CD) in Geneva and meetings associated with treaties such as the 1968 Non-Proliferation Treaty (NPT), the 1996 Comprehensive Nuclear-Test-Ban Treaty (CTBT) and the 2017 Treaty on the Prohibition of Nuclear Weapons (TPNW). A more recent multilateral process is the annual United Nations conference on the establishment of a zone free of weapons of mass destruction (WMD) in the Middle East.

This section reviews developments in 2021 in relation to these treaties and initiatives, looking in turn at the NPT, the TPNW, the Middle East conference and the CTBT. Developments in the Vienna negotiations on restoring the Joint Comprehensive Plan of Action (JCPOA) on Iran's nuclear programme are covered in section II. While the entry into force of the TPNW in January marked a milestone in efforts to strengthen the global norm on nuclear disarmament, the lack—once again—of significant nuclear developments in the CD in 2021 reflected the lack of practical progress towards that goal.<sup>1</sup>

#### **The postponed review conference of the Non-Proliferation Treaty**

The 10th review conference of the parties to the NPT was initially planned for April–May 2020.<sup>2</sup> Due to the ongoing Covid-19 pandemic, the conference was first delayed until January 2021, then August 2021 and then further postponed until 4–28 January 2022.<sup>3</sup>

Various state groupings issued statements and working papers in anticipation of the conference. In December 2021 the five NPT-recognized nuclear weapon states—China, France, the Russian Federation, the United Kingdom and the United States, known as the P5—issued a joint communiqué that emphasized, among other things, 'strategic risk reduction' but did not specify concrete measures for achieving this beyond a discussion on nuclear doctrines and policies.<sup>4</sup> Risk reduction is viewed as being one of the few areas

<sup>1</sup> For a description and other details of the CD see annex B, section I, in this volume.

<sup>2</sup> For a summary and other details of the NPT see annex A, section I, in this volume. On earlier developments see Erästö, T., Kile, S. N. and Fedchenko, V., 'Multilateral arms control, disarmament and non-proliferation treaties and initiatives', *SIPRI Yearbook 2021*.

<sup>3</sup> Zlauvinen, G., President-designate of the 10th NPT Review Conference, Letter to NPT states parties, 25 Oct. 2021

<sup>4</sup> P5 Conference, Joint communiqué, Paris, 2–3 Dec. 2021.

of common ground at the review conference.<sup>5</sup> It was also highlighted by other groupings, such as the Stockholm Initiative for Nuclear Disarmament and the Non-Proliferation and Disarmament Initiative (NPDI), which both consist of non-nuclear weapon states and also include states that are included in USA's extended nuclear deterrence 'umbrella'.<sup>6</sup> However, as the Group of the Non-Aligned States stressed, risk reduction is no substitute for nuclear disarmament.<sup>7</sup>

The key challenge to the NPT remains the lack of progress towards the commitment under Article VI of the treaty for all the parties to 'pursue negotiations in good faith on effective measures relating to . . . nuclear disarmament, and on a treaty on general and complete disarmament'. In addition to the lack of implementation of the disarmament steps that had been agreed by consensus at the review conferences in 1995, 2000 and 2010, uncertainty prevailed as to whether the P5 still viewed themselves as bound by those previous decisions.

The general mood of the review conference discussions was somewhat improved by the extension in February 2021 of the 2010 Russian–US New Strategic Arms Reduction Treaty (New START; see section I). However, by the end of the year there was still no sign of follow-on negotiations on further nuclear cuts by Russia and the USA, while nuclear modernization programmes continued in these two countries as well as in other nuclear-armed states.<sup>8</sup> At the same time, new developments created additional challenges for the NPT: the JCPOA further deteriorated during the year, and in March the UK decided to increase the cap on the number of warheads in its nuclear stockpile and reduce nuclear transparency.<sup>9</sup> In addition, in September the UK and the USA agreed to sell nuclear-powered submarines to Australia (the so-called AUKUS agreement), thereby allowing it to remove nuclear material from the NPT-mandated safeguards system.<sup>10</sup>

The UN High Representative for Disarmament Affairs, Izumi Nakamitsu, nevertheless characterized the mood in the run-up to the review conference

<sup>5</sup> van der Meer, S., 'Nuclear risk reduction as an interim success for the NPT Review Conference?', European Leadership Network, 23 June 2020.

<sup>6</sup> 10th NPT Review Conference, 'A nuclear risk reduction package', Working paper submitted by the Stockholm Initiative, NPT/CONF.2020/WP.9, 14 May 2021; and 10th NPT Review Conference, 'Recommendations for consideration by the Tenth Review Conference of the parties to the Treaty on the Non-Proliferation of Nuclear Weapons', Joint working paper submitted by the members of the Non-Proliferation and Disarmament Initiative, NPT/CONF.2020/WP.10, 10 Sep. 2021.

<sup>7</sup> 10th NPT Review Conference, 'Nuclear disarmament', Working paper submitted by the members of the Group of Non-Aligned States Parties to the NPT, NPT/CONF.2020/WP.20, 22 Nov. 2021.

<sup>8</sup> On these nuclear modernization programmes see chapter 10, sections I–IX, in this volume.

<sup>9</sup> See section II in this chapter and chapter 10, section III, in this volume; and British Government, *Global Britain in a Competitive Age: The Integrated Review of Security, Defence, Development and Foreign Policy*, CP 403 (Stationery Office: London, Mar. 2021), p. 76.

<sup>10</sup> Acton, J. M., 'Why the AUKUS submarine deal is bad for non-proliferation—and what to do about it', Carnegie Endowment for International Peace, 21 Sep. 2021.

scheduled for January 2022 as ‘cautiously optimistic’.<sup>11</sup> At the same time, she appealed for states parties to show flexibility and ‘civility in discourse’ to ensure a successful outcome. While differences over the TPNW had marked previous NPT meetings, it seemed that compromise language acknowledging the entry into force of the TPNW in 2021 could help to avoid such differences undermining consensus at the NPT review conference.<sup>12</sup> In turn, Ambassador Gustavo Zlauvinen of Argentina, the president-designate of the review conference, stressed that state parties ‘need to be ready . . . to engage in real direct dialogue and negotiations’ rather than ‘recitation of national positions’.<sup>13</sup> He also noted that the two years of consultations about the review conference with states parties had clarified the need for progress in the implementation of Article VI as well as practical nuclear risk-reduction measures.

Less than a week before the review conference was due to start, the meeting was postponed again due to a surge in Covid-19 infections in New York. Zlauvinen tentatively suggested 1–26 August 2022 as the new dates, subject to formal confirmation by the states parties.<sup>14</sup>

### **The Treaty on the Prohibition of Nuclear Weapons**

The 2017 Treaty on the Prohibition of Nuclear Weapons entered into force on 22 January 2021, 90 days after the 50th state had ratified or acceded to it.<sup>15</sup> By the end of the year, the TPNW had 59 states parties and had been signed but not yet ratified by a further 30 states. The entry into force of the treaty was viewed as a major turning point in multilateral efforts to advance nuclear disarmament; the UN secretary-general, António Guterres, described it as ‘an important step towards a world free of nuclear weapons’, and civil society representatives described it as a ‘critical milestone’.<sup>16</sup>

The TPNW is the first multilateral treaty establishing a comprehensive ban on nuclear weapons, including their development, production, testing, acquisition, stockpiling, transfer and possession, as well as their use and

<sup>11</sup> Nakamitsu, I., High Representative for Disarmament Affairs, Remarks at the Third Track 1.5 Meeting for Substantive Advancement of Nuclear Disarmament, 9 Dec. 2021.

<sup>12</sup> Kimball, D. G., ‘NPT states prepare for a critical conference’, *Arms Control Today*, vol. 51, no. 10 (Dec. 2021).

<sup>13</sup> Zlauvinen, G., ‘Prospects of the upcoming X NPT Review Conference’, Public lecture, PIR Center, 1 Nov. 2021.

<sup>14</sup> Deen, T., ‘Review Conference on Nuclear Non-Proliferation Treaty stalled due to rising COVID-19 infections’, *InDepthNews*, 1 Jan. 2022.

<sup>15</sup> For a summary and other details of the TPNW, including lists of the parties and signatories, see annex A, section I, in this volume. On its entry into force see Erästö et al. (note 2), pp. 435–37.

<sup>16</sup> United Nations, ‘Guterres hails entry into force of treaty banning nuclear weapons’, 22 Jan. 2021; and International Campaign to Abolish Nuclear Weapons (ICAN), ‘The Treaty on the Prohibition of Nuclear Weapons enters into force’, 22 Jan. 2021.

threat of use.<sup>17</sup> The treaty builds in particular on international humanitarian law and was inspired by an international initiative that highlighted the catastrophic humanitarian consequences of any use of nuclear weapons. The TPNW negotiations took place within the UN, initiated by a General Assembly decision in December 2016, and the treaty was adopted by the General Assembly with a majority vote of 122 states to 1 on 7 July 2017.<sup>18</sup>

The entry into force of the treaty paved the way for the next milestone—the first meeting of states parties (MSP1), which the treaty requires to be held within one year.<sup>19</sup> Initially scheduled for January 2022, MSP1 was subsequently postponed until 22–24 March 2022, to avoid an overlap with the planned NPT review conference, and then again until July 2022.<sup>20</sup>

Ambassador Alexander Kmentt of Austria, the president-designate of MSP1, argued that the meeting provides an opportunity ‘to put the implementation of the treaty on a strong and solid track’.<sup>21</sup> Among other subjects, the meeting will be able to initiate discussion to clarify certain TPNW articles that are open to interpretation, such as what exactly it means to ‘assist, encourage or induce’ activities prohibited by the treaty in Article 1.<sup>22</sup>

According to Kmentt, the TPNW states parties view the treaty as ‘an essential normative supplement and further development of and complement to the [NPT]’.<sup>23</sup> The nuclear weapon states, in contrast, have portrayed the TPNW and its approach of outlawing nuclear weapons as being a threat to the NPT-based international order.<sup>24</sup> As in previous years, in 2021 the outcome of voting in the UN General Assembly testified to this controversy; a resolution that called upon ‘all States that have not yet done so to sign, ratify, accept, approve or accede to the Treaty at the earliest possible date’ was supported by 128 votes, all from non-nuclear weapon states, whereas the 42 negative votes included all nine nuclear-armed states and their allies.<sup>25</sup> Two member states of the North Atlantic Treaty Organization (NATO)—Germany and Norway—

<sup>17</sup> For background see Kile, S. N., ‘Treaty on the Prohibition of Nuclear Weapons’, *SIPRI Yearbook 2018*; and Erästö, T., ‘Treaty on the Prohibition of Nuclear Weapons’, *SIPRI Yearbook 2019*.

<sup>18</sup> Kile (note 17), p. 314.

<sup>19</sup> TPNW (note 15), Article 8.

<sup>20</sup> Kmentt, A., President-designate of TPNW IMSPI, Letter to the UN secretary-general, 10 Aug. 2021, annexed to A/75/990, 16 Aug. 2021; and United Nations Office of Disarmament Affairs, ‘Note verbale from the Secretary-General of the United Nations, dated 4 April 2022, on the convening of the first Meeting of States Parties to the TPNW’, 4 Apr. 2022.

<sup>21</sup> Kmentt, A., Statement at the 2021 World Conference against A and H Bombs, 6 Aug. 2021.

<sup>22</sup> International Committee of the Red Cross (ICRC), ‘The prohibition to assist, encourage or induce prohibited activities under the Treaty on the Prohibition of Nuclear Weapons’, ICRC Briefing Note, 24 Apr. 2019.

<sup>23</sup> Kmentt (note 21).

<sup>24</sup> See Kile (note 17); and Erästö (note 17).

<sup>25</sup> UN General Assembly Resolution 76/34, 6 Dec. 2021, para. 8; and United Nations, Digital Library, ‘Treaty on the Prohibition of Nuclear Weapons: Resolution / adopted by the General Assembly’, Voting data, 6 Dec. 2021.

nevertheless announced their intention to attend MSP1 as observers.<sup>26</sup> This was viewed as a significant departure from the prevailing NATO policy line of opposing the TPNW, which has created pressure among member states to refrain from any action that might signal support for the treaty.<sup>27</sup> Kmentt noted that all states had been invited to the conference and he called for ‘those who are still sceptical and stuck in the belief of the necessity of nuclear deterrence’ to join and ‘to engage with the profound humanitarian arguments on which the TPNW rests’.<sup>28</sup>

### **The Conference on the Establishment of a Middle East Zone Free of Weapons of Mass Destruction**

Initially planned for November 2020 but postponed due to the pandemic, the second session of the Conference on the Establishment of a Middle East Zone Free of Nuclear Weapons and Other Weapons of Mass Destruction took place between 29 November and 3 December 2021 at UN Headquarters in New York.<sup>29</sup> The conference was convened by the UN secretary-general and presided over by Ambassador Mansour Al-Otaibi of Kuwait. It was attended by 19 Middle Eastern states and observed by China, France, Russia and the UK as well as relevant international organizations.<sup>30</sup> As at the first session, in 2019, the USA and the region’s only nuclear-armed state, Israel, did not attend the meeting despite being invited.

In 2018 the UN General Assembly decided to hold annual conferences on establishment of a Middle East WMD-free zone until that goal is achieved.<sup>31</sup> That decision had been preceded by calls in the UN General Assembly since 1974 to free the Middle East of nuclear weapons, and by unproductive efforts since 1995 to promote a WMD-free zone in the region as part of the NPT review process. While this current UN process is therefore independent of the NPT review process, it builds on the NPT and, in particular, the Middle East Resolution adopted at the 1995 NPT review conference whereby the

<sup>26</sup> International Campaign to Abolish Nuclear Weapons (ICAN), ‘Germany expected to observe TPNW MSP’, 25 Nov. 2021.

<sup>27</sup> Davis, I., ‘NATO Secretary General attempts to hold the line on nuclear sharing: Germany and Norway caught in the crosshairs’, NATO Watch, 23 Nov. 2021.

<sup>28</sup> Kmentt (note 21).

<sup>29</sup> United Nations, Conference on the Establishment of a Middle East Zone Free of Nuclear Weapons and Other Weapons of Mass Destruction, ‘Second session’, Decision, A/CONF.236/DEC.5, 21 Sep. 2020.

<sup>30</sup> United Nations, Conference on the Establishment of a Middle East Zone Free of Nuclear Weapons and Other Weapons of Mass Destruction, Report on the work of its second session, A/CONF.236/2021/4, 3 Dec. 2021, para. 2.

<sup>31</sup> United Nations, General Assembly, ‘Convening of a conference on the establishment of a Middle East zone free of nuclear weapons and other weapons of mass destruction’, Decision 73/546, 22 Dec. 2018. For background see Erästö, T. and Kile, S. N., ‘Multilateral nuclear arms control, disarmament and non-proliferation treaties and initiatives’, *SIPRI Yearbook 2020*.

establishment of the Middle East WMD-free zone was linked to the decision to indefinitely extend the NPT.<sup>32</sup>

Among other issues, the conference report reaffirms the importance of Israel's accession to the NPT.<sup>33</sup> While it contains no reference to the TPNW, the report notes that a future treaty on a Middle East WMD-free zone 'should recognize the catastrophic humanitarian and environmental consequences' resulting from any WMD use.<sup>34</sup> Regarding verification, the report notes that 'the [zone] treaty should avoid duplicating other existing international arrangements and could rely on existing instruments, including the comprehensive safeguards of [the International Atomic Energy Agency (IAEA)] and the verification regime of the Organisation for the Prohibition of Chemical Weapons'—although these could be supplemented by a 'regional verification mechanism'.<sup>35</sup> The report also stressed the responsibility of all nuclear-armed states to provide legally binding negative security assurances to treaty members.<sup>36</sup>

The next session of the conference was scheduled for 14–18 November 2022. A working committee was established to continue deliberations during the intersessional period, to convene at least two meetings.

While critics have downplayed the significance of the conference, advocates see in it an opportunity to 'turn the Middle East from a region of global concern, where chemical weapons have been widely employed and where a potential nuclear-arms race could be unleashed at any moment, into a region with a legally binding and humanitarian-based regional security system, capable of dissolving former rivalries'.<sup>37</sup>

### **Twenty-five years of the Comprehensive Nuclear-Test-Ban Treaty**

The year 2021 marked the 25th anniversary of the Comprehensive Nuclear-Test-Ban Treaty: on 10 September 1996 the UN General Assembly voted 158 to 3, with 5 abstentions, to adopt the treaty as negotiated at the CD.<sup>38</sup> By the end of 1996, 138 states had signed the treaty.<sup>39</sup> Ratifications by the Comoros

<sup>32</sup> Erästö and Kile (note 31); United Nations, A/CONF.236/2021/4 (note 30), para. 17; and 1995 NPT Review and Extension Conference, Resolution on the Middle East, 11 May 1995, NPT/CONF.1995/21 (Part I).

<sup>33</sup> United Nations, A/CONF.236/2021/4 (note 30), para. 18.

<sup>34</sup> United Nations, A/CONF.236/2021/4 (note 30), para. 21.

<sup>35</sup> United Nations, A/CONF.236/2021/4 (note 30), paras 30–31.

<sup>36</sup> United Nations, A/CONF.236/2021/4 (note 30), para. 46.

<sup>37</sup> Bandarra, L. and Dolev, S., 'Pathways to a WMD-free zone in the Middle East', *Bulletin of the Atomic Scientists*, 2 Dec. 2021.

<sup>38</sup> For a summary and other details of the CTBT see annex A, section I, in this volume.

<sup>39</sup> Arnett, E., 'The Comprehensive Nuclear Test-Ban Treaty', *SIPRI Yearbook 1997*, p. 403.

and Cuba in 2021 brought the total number of ratifying states to 170, while a further 15 had signed but not yet ratified.<sup>40</sup>

Upon its entry into force, the CTBT will prohibit its states parties from conducting ‘any nuclear weapon test explosion or any other nuclear explosion’ anywhere in the world.<sup>41</sup> However, before the CTBT can enter into force, it must be ratified by 44 states named in the treaty’s Annex 2, which all had nuclear power or research reactors when the treaty was negotiated. Eight of these states—China, Egypt, India, Iran, Israel, the Democratic People’s Republic of Korea (DPRK, or North Korea), Pakistan and the USA—have yet to do so.

While the CTBT is still not in force, steady progress is being made on the operational aspects of the treaty by the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO). The commission is a plenary body composed of all the treaty’s states signatories. It is assisted by a Provisional Technical Secretariat (PTS), which is working to establish the CTBT verification regime. When completed, this regime will consist of an International Monitoring System (IMS) with 321 seismic, hydroacoustic, infrasound and radionuclide monitoring stations and 16 laboratories around the globe to detect evidence of any nuclear explosion; and an International Data Centre (IDC) to process and analyse the data registered at the monitoring stations and transmit it to member states. As of 31 December 2021, 303 of these 337 facilities were certified operational, with the 304th station, PS35 in Peleduy, Russia, expected to be certified in early 2022.<sup>42</sup>

### *Election of the executive secretary*

In 2021 the CTBTO was finally able to resolve the drawn-out and contentious process of selecting its next executive secretary, who oversees the staff of the PTS and the annual budget of approximately US\$130 million.<sup>43</sup> The nomination and voting process was complicated in 2020 by disagreements on whether countries with unpaid financial dues could vote in the election of the executive secretary, the effects of the Covid-19 pandemic, and the decision of the outgoing executive secretary, Lassina Zerbo, to break with general practice across the UN system and the CTBT requirement (when it enters into force) for leaders of international organizations to serve no more than two consecutive terms.<sup>44</sup> The commission resolved the first and the

<sup>40</sup> CTBTO, ‘Cuba joins the Comprehensive Nuclear-Test-Ban Treaty’, Press release, 4 Feb. 2021; and CTBTO, ‘Comoros becomes 170th state to ratify the CTBT’, Press release, 19 Feb. 2021.

<sup>41</sup> CTBT (note 38), Article I(1).

<sup>42</sup> CTBTO, ‘Station profiles’, [n.d.]; and CTBTO, ‘Beating snowstorms, Russia’s last primary seismic station is installed’, 11 Nov. 2021.

<sup>43</sup> CTBTO, *Business Continuity: Annual Report 2020* (CTBTO: Vienna, 2021), p. 91.

<sup>44</sup> On these three issues see Erästö et al. (note 2), pp. 438–40.

most contentious of the three issues on 26 March 2021, when it decided by consensus that any state that had taken part in the voting in December 2020, any new signatory (i.e. Cuba) and any other state that paid its assessed dues would be eligible to cast a vote.<sup>45</sup>

On 20 May 2021 Robert Floyd of Australia won the support of 96 states (exactly two-thirds of the states voting).<sup>46</sup> He started his term on 1 August 2021 as the fourth executive secretary, following Zerbo of Burkina Faso (2013–21), Tibor Tóth of Hungary (2005–13) and Wolfgang Hoffmann of Germany (1997–2005).<sup>47</sup>

### *Marking the 25th anniversary*

In 2021 the CTBT member states conducted several events marking the 25th anniversary of the opening for signature of the treaty. On 23 and 24 September, in accordance with Article XIV of the treaty, the states that had ratified the CTBT convened the biannual Conference on Facilitating the Entry into Force of the CTBT, with other signatory states attending as observers.<sup>48</sup> In an address to the conference, a senior US official emphasized the support of the administration of President Joe Biden for the treaty and its commitment ‘to work to achieve its entry into force’.<sup>49</sup> This represented a clear change from the policy of the previous administration, of President Donald J. Trump, which in 2020 is reported to have discussed the possibility of resuming nuclear weapon tests.<sup>50</sup> The USA also reiterated that it ‘continues to observe its zero-yield nuclear explosive testing moratorium, and calls on all states possessing nuclear weapons to declare or maintain such a moratorium’.

On 27 September the UN Security Council dedicated a meeting to the CTBT. The CTBTO executive secretary, the head of the UN Office for Disarmament Affairs, civil society representatives and envoys from Ireland (then president of the Security Council), Estonia, the USA, China, Russia and other states spoke in support of the treaty.<sup>51</sup>

<sup>45</sup> Kimball, D. G., ‘States finally settle on next leader for CTBTO’, *Arms Control Today*, vol. 51, no. 5 (June 2021).

<sup>46</sup> Kimball (note 45).

<sup>47</sup> CTBTO, ‘Robert Floyd takes office as CTBTO executive secretary’, Press release, 2 Aug. 2021.

<sup>48</sup> Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty, Report of the conference, CTBT-Art.XIV/2021/6, 30 Sep. 2021.

<sup>49</sup> Jenkins, B., US Under Secretary for Arms Control and International Security, Remarks to the Conference on Facilitating the Entry into Force of the Comprehensive Nuclear-Test-Ban Treaty, 23 Sep. 2021.

<sup>50</sup> Erästö et al. (note 2), pp. 442–43.

<sup>51</sup> United Nations, Security Council, ‘Comprehensive Test-Ban Treaty “essential element of nuclear disarmament”, high representative tells Security Council’, SC/14645, 27 Sep. 2021.



The Security Council had previously addressed the CTBT five years earlier, when it marked the 20th anniversary of the treaty on 22 September 2016.<sup>52</sup> On that occasion it noted a joint statement on the CTBT made by the P5, in particular the part pointing out that ‘a nuclear-weapon test explosion or any other nuclear explosion would defeat the object and purpose of the CTBT’.<sup>53</sup> Unlike in 2016, the 2021 Security Council session did not result in a joint statement or resolution due to the opposition of France.<sup>54</sup>

*The impact of 25 years of the Comprehensive Nuclear-Test-Ban Treaty*

During the 51 years between the first nuclear test, on 16 July 1945, and the opening for signature of the CTBT, six states conducted a total of 2048 nuclear test explosions.<sup>55</sup> During the subsequent 25 years, only 10 additional nuclear tests were conducted, all by three states outside the treaty—India, Pakistan and North Korea. While the CTBT’s goal of a complete prohibition on ‘any nuclear weapon test explosion or any other nuclear explosion’ anywhere in the world has not been reached, the treaty has had a significant impact in five important areas.

First, the CTBT helped to slow down the research and development of global nuclear weapon capabilities. Although the treaty only bans nuclear test explosions of any yield and does not proscribe other nuclear weapon-related work, the ability of nuclear weapon states to improve existing nuclear warheads and reliably develop new ones has been severely limited by the treaty.<sup>56</sup> ‘Live’ nuclear test explosions are important for development of advanced warheads. For example, France required 22 nuclear tests to develop its TN-75 warhead.<sup>57</sup>

Second, the CTBT helped to curb significant radioactive contamination—both of the atmosphere globally and of the nuclear test sites locally. Nuclear weapon tests made the main man-made contribution to the exposure of the world population to radiation since 1945.<sup>58</sup>

<sup>52</sup> Rauf, T., “‘Unfinished business’ on the anniversary of the Comprehensive Nuclear-Test-Ban Treaty”, 26 Sep. 2016.

<sup>53</sup> UN Security Council Resolution 2310, 23 Sep. 2016, para. 4; and Joint statement on the Comprehensive Nuclear-Test-Ban Treaty by the Nuclear Non-Proliferation Treaty nuclear-weapon states, 15 Sep. 2016.

<sup>54</sup> Kimball, D. G., ‘On CTBT anniversary, UN members call for action’, *Arms Control Today*, vol. 51, no. 8 (Oct. 2021).

<sup>55</sup> Those 6 states were the USA, the Soviet Union/Russia, the UK, France, China and India. Ferm, R., ‘Nuclear explosions, 1945–96’, *SIPRI Yearbook 1997*.

<sup>56</sup> Garwin, R. L. and Simonenko, V. A., ‘Nuclear weapon development without nuclear testing’, Pugwash Workshop on Problems in Achieving a Nuclear-Weapon-Free World, 25–27 October 1996.

<sup>57</sup> Norris, R. S., ‘French and Chinese nuclear weapon testing?’, *Security Dialogue*, vol. 27, no. 1 (Mar. 1996), p. 46.

<sup>58</sup> UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), *Sources and Effects of Ionizing Radiation*, UNSCEAR 2000 Report to the General Assembly (United Nations: New York, 2000), pp. 5–6.

Third, it has been argued that the CTBT, even though it is still not universal and not in force, has introduced an international norm against nuclear testing. As pointed out by credible and influential non-proliferation and disarmament researchers, even though India and Pakistan—two nuclear-armed states that did not join the treaty—conducted testing campaigns after the CTBT was opened for signature, they then ceased and stated that they would not test further.<sup>59</sup> One researcher has even argued that Israel and North Korea have also been influenced by this norm.<sup>60</sup>

Fourth, in preparation for the treaty's entering into force, the CTBTO has created a unique international global monitoring network of stations and laboratories for treaty verification. The IMS demonstrated its proficiency by detecting and analysing data from all six known nuclear tests conducted by North Korea between 2006 and 2017.<sup>61</sup> In 2016 the UN Security Council recognized that the IMS and the IDC 'contribute to regional stability as a significant confidence-building measure, and strengthen the nuclear non-proliferation and disarmament regime'.<sup>62</sup> Despite its provisional status, the IMS has become for many countries 'a provider of global data that national technical means could not match'.<sup>63</sup>

Finally, the IMS data and reports produced by the PTS are made available to all signatory states, which often choose to use that data to foster earth sciences research and capacity building. In addition, the CTBTO awards contracts to operate its monitoring stations and radionuclide laboratories to local institutions. This has made the CTBTO an important contributor of data to scientific communities and a significant contributor to building and sustaining scientific capacity beyond the fields of nuclear non-proliferation and disarmament verification.<sup>64</sup>

<sup>59</sup> Bunn, G., 'The status of norms against nuclear testing', *Nonproliferation Review*, vol. 6, no. 2 (winter 1999), p. 5; Tannenwald, N., 'The great unraveling: The future of the nuclear normative order', N. Tannenwald and J. M. Acton, *Emerging Risks and Declining Norms in the Age of Technological Innovation and Changing Nuclear Doctrines* (American Academy of Arts and Sciences: Cambridge, MA, 2018), pp. 22–23.

<sup>60</sup> Kimball, D. G., 'Preserving the nuclear testing taboo', *Arms Control Today*, vol. 51, no. 7 (Sep. 2021).

<sup>61</sup> Fedchenko, V., 'Nuclear explosions, 1945–2017', *SIPRI Yearbook 2018*.

<sup>62</sup> UN Security Council Resolution 2310 (note 53), para. 7.

<sup>63</sup> Giovannini, F., 'The CTBT at 25 and beyond', *Arms Control Today*, vol. 51, no. 7 (Sep. 2021).

<sup>64</sup> CTBTO, 'Science and Technology—the conference series', [n.d.].