

ARTICLES

# PROTECTING NUCLEAR POWER PLANTS DURING WAR: IMPLICATIONS FROM UKRAINE

by Erika Weinthal and Carl Bruch

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## SUMMARY

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Prior to Russia's invasion of Ukraine, the direct targeting of nuclear power plants (NPP) was largely unimaginable in armed conflict. International humanitarian law (IHL) requires their protection, but since February 2022, Russia has directly targeted nuclear facilities, including the nonoperational Chornobyl NPP and the operational Zaporizhzhia NPP. This Article documents how NPPs in Ukraine have come under direct attack, been occupied, and used for military purposes. It highlights the challenges owing to (1) the complexity of NPP infrastructure and (2) the growing presence of international actors who have not had to engage previously in the protection of NPPs; and explores policy measures that might strengthen IHL and provide accountability mechanisms.

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One of the first acts of Russia's invasion of Ukraine was to occupy the Chornobyl Nuclear Power Plant (NPP) and the Chornobyl Exclusion Zone on February 24, 2022.<sup>1</sup> Within days, Russian forces also occupied the nearby town of Slavutych, where most workers from the Chornobyl NPP live.<sup>2</sup> The weaponization of NPPs during international armed conflict is unprecedented; the war in Ukraine has, however, brought to the fore the dangers of nuclear plants coming under direct attack, occupation, and use for military purposes.<sup>3</sup> Ukraine is home to 15

nuclear power reactors at four different sites. Despite the Chornobyl accident in 1986, nuclear power has remained an important source of energy for Ukraine. Moreover, the Chornobyl NPP still contains more than 20,000 spent fuel rods, which require a constant stream of energy for the cooling pools.<sup>4</sup>

For decades, scholars and policymakers have sought to prevent the proliferation of nuclear weapons and any chance of nuclear war. One of the most notable successes was the signing of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) in 1968, which entered into force in 1970.<sup>5</sup> This treaty allowed for the promotion of the "peaceful applications of nuclear technology,"—that is, the development and use of nuclear energy.<sup>6</sup> Other treaties that have sought to reduce the numbers of strategic nuclear weapons held by the United States and the Soviet Union/

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1. *Briefing on the Environmental Damage Caused by the Russian Invasion of Ukraine (19-22 April 2022)*, MINISTRY ENV'T PROT. & NAT. RES. UKR. (Apr. 22, 2022), <https://mepr.gov.ua/en/news/39125.html>.
2. David Stern & Rachel Pannett, *Russian Forces Are Occupying City Housing Chernobyl Workers, Mayor Says*, WASH. POST (Mar. 26, 2022), <https://www.washingtonpost.com/world/2022/03/26/slavutych-chnobyl-occupied-ukraine-russia/>.
3. Political scientists use the term "weaponize." See, e.g., Marwa Daoudy, *Water Weaponization in the Syrian Conflict: Strategies of Domination and Cooperation*, 96 INT'L AFFS. 1347 (2020), available at <https://doi.org/10.1093/iaa/iaa131>. However, lawyers working in the field of international humanitar-

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ian law (IHL) refrain from using this term. Conversation with IHL lawyers, Geneva, Switz. (Oct. 2022). We acknowledge that "weaponization" is a political term and not a legal one.

4. Ajit Niranjana, *Chernobyl: What Are the Safety Risks as War Rages?*, DEUTSCHE WELLE (Mar. 9, 2022), <https://www.dw.com/en/ukraine-as-war-rages-what-are-the-risks-at-the-chnobyl-nuclear-plant/a-61071864>.
5. United Nations Office for Disarmament Affairs, *Treaty on the Non-Proliferation of Nuclear Weapons (NPT)—Text of the Treaty*, <https://www.un.org/disarmament/wmd/nuclear/npt/text> (last visited Feb. 5, 2023).
6. Since the treaty was extended indefinitely in May 1995, 191 countries have ratified the NPT.

Russia include the 1991 U.S.-Soviet Strategic Arms Reduction Treaty (START I), and the 1993 Treaty Between the United States of America and the Russian Federation on Measures for the Further Reduction and Limitation of Strategic Offensive Arms (START II).<sup>7</sup> In 1997, the International Court of Justice (ICJ) issued an advisory opinion on nuclear weapons that called for States to pursue in good faith negotiations to bring about nuclear disarmament.<sup>8</sup>

Mounting global awareness about the threat of a “nuclear winter” in the 1960s and 1970s, along with the U.S. military’s use of Agent Orange during the Vietnam War, had galvanized the international community’s efforts to not only establish the NPT, but also to address the environmental and health consequences of war. Important landmarks include the 1976 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ENMOD), along with the 1977 Additional Protocols I and II to the Geneva Conventions (AP I and AP II). Most notably, Article 56 (AP I) called for the protection of “works or installations containing dangerous forces, namely dams, dykes and nuclear electrical generating stations” in international armed conflicts.<sup>9</sup> The International Law Commission (ILC) has further worked to codify and progressively develop protection to the environment during armed conflict, resulting in the United Nations (U.N.) General Assembly formally adopting a resolution calling for the widest possible dissemination of the ILC’s 27 legal principles on “Protection of the Environment in Relation to Armed Conflicts” and associated commentaries.<sup>10</sup>

One of the most notable accomplishments of nuclear nonproliferation took place 30 years ago, when Ukraine gave up its nuclear weapons in return for security guarantees from the United States, Russia, and the United Kingdom.<sup>11</sup> For realist scholars in the field of international relations, Ukraine’s decision to voluntarily relinquish its nuclear weapons was puzzling, as nuclear weapons are considered an effective deterrent to threats to a country’s national

security.<sup>12</sup> Ukraine, however, received significant compensation for its highly enriched uranium,<sup>13</sup> which included fuel rods for its civilian NPPs, over which Ukraine retained control of operations.<sup>14</sup> Looking back now at the historical record, John Mearsheimer, however, had ominously warned in 1993 that if Ukraine’s nuclear reactors were “left unattended or attacked during a conventional war, . . . [t]he consequences of such a war would dwarf the death and suffering in the Balkans, where more than 50,000 people have died since summer of 1991.”<sup>15</sup>

Russia’s invasion of Ukraine has blurred the conventional distinction between nuclear weapons and nuclear power, whereby the former was designed for military use and the latter ostensibly for civilian use. While AP I to the Geneva Conventions recognized the need to protect NPPs, up until Russia’s invasion of Ukraine, the international community had largely focused on protecting water, conventional energy, and medical infrastructure during armed conflicts, especially during the armed conflicts in the Middle East and North Africa following the so-called Arab Spring. The wars in the Middle East and North Africa over the past decade have, however, underscored the limitations of international humanitarian law (IHL), as both State and non-State actors have consistently targeted critical infrastructure, disrupting civilian access to water and other basic services.<sup>16</sup> In a similar manner, since 2014, Russia had destroyed critical water infrastructure in the Donetsk region.<sup>17</sup>

Precisely because NPPs are civilian objects and contain dangerous forces, under IHL, they are to be protected and should not be attacked during war.<sup>18</sup> Considering the applicability of IHL in this case of international armed conflict between Russia and Ukraine, this Article explores the challenges to protecting NPPs owing to (1) the complexity of NPP infrastructure, which often extends beyond the actual installation itself; and (2) the growing presence of international actors who have not had to engage previously in the protection of NPPs or works or installations containing dangerous forces during active armed conflict. Since Russia’s invasion of Ukraine in February 2022, Russia has directly targeted nuclear facilities, including the nonoperational Chornobyl NPP and the operational Zaporizhzhia NPP, both of which contain dangerous forces, as well as energy and water resources that support those NPPs. As

7. U.S. Department of State, *Treaty Between the United States of America and the Russian Federation on Further Reduction and Limitation of Strategic Offensive Arms (START II)*, <https://2009-2017.state.gov/t/avc/trty/102887.htm> (last visited Feb. 5, 2023). On February 21, 2023, Russia announced it was suspending participation in New START. *Russia’s New START Suspension, Special Op and Economic Measures*, TASS (Feb. 21, 2023), <https://tass.com/politics/1579793>.

8. ICJ, *Legality of the Threat or Use of Nuclear Weapons*, <https://www.icj-cij.org/en/case/95> (last visited Feb. 5, 2023).

9. International Committee of the Red Cross (ICRC) International Humanitarian Law Databases, *Article 56—Protection of Works and Installations Containing Dangerous Forces*, <https://ihl-databases.icrc.org/ihl/WebART/470-750071> (last visited Feb. 5, 2023).

10. ILC, *Summaries of the Work of the International Law Commission: Protection of the Environment in Relation to Armed Conflicts*, [https://legal.un.org/ilc/summaries/8\\_7.shtml](https://legal.un.org/ilc/summaries/8_7.shtml) (last updated Jan. 23, 2023); *Time to Transition to PERAC Implementation*, CONFLICT & ENV’T OBSERVATORY (Dec. 8, 2022), <https://ceobs.org/states-adopt-new-legal-framework-on-the-environmental-impact-of-war/>.

11. William J. Broad, *Ukraine Gave Up a Giant Nuclear Arsenal 30 Years Ago. Today There Are Regrets*, N.Y. TIMES (Feb. 5, 2022), <https://www.nytimes.com/2022/02/05/science/ukraine-nuclear-weapons.html>; Sherman W. Garnett, *Ukraine’s Decision to Join the NPT*, 25 ARMS CONTROL TODAY 7 (1995).

12. John Mearsheimer, *The Case for a Ukrainian Nuclear Deterrent*, 72 FOREIGN AFFS. 50 (1993); Scott Sagan, *Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb*, 21 INT’L SEC’Y 54 (1996/1997).

13. Garnett, *supra* note 11.

14. Fact Sheet, *The White House, Removal of Nuclear Warheads From Ukraine* (June 1, 1996), <https://clintonwhitehouse6.archives.gov/1996/06/1996-06-01-fact-sheet-on-ukraine-nuclear-warheads-removal.html>.

15. Mearsheimer, *supra* note 12, at 55.

16. E.g., Jeannie Sowers & Erika Weinthal, *Humanitarian Challenges and the Targeting of Civilian Infrastructure in the Yemen War*, 97 INT’L AFFS. 157 (2021).

17. *Water Under Fire*, U.N. CHILDREN’S FUND (Sept. 19, 2019), <https://www.unicef.org/ukraine/en/stories/water-under-fire>.

18. Abby Zeith & Eirini Giorgou, *Dangerous Forces: The Protection of Nuclear Power Plants in Armed Conflict*, ICRC: HUMANITARIAN L. & POL’Y (Oct. 18, 2022), <https://blogs.icrc.org/law-and-policy/2022/10/18/protection-nuclear-power-plants-armed-conflict/>.

both operational and nonoperational NPPs have increasingly been targeted, the role of the International Atomic Energy Agency (IAEA) has accordingly evolved to bolster protections of NPPs during active war and to mitigate harm from the shelling of works and installations containing dangerous forces.

Whereas recent scholarship pertaining to the targeting of infrastructure in the Middle East and North Africa has documented the types of infrastructure targeted, and by whom, to explain patterns and motivations for destroying infrastructure during armed conflicts,<sup>19</sup> the Article does not strive to explicate the reasons undergirding Russia's targeting of nuclear infrastructure. Rather, it highlights the extent to which the bombardment of works and installations containing dangerous forces (AP I), which includes both operational and nonoperational NPPs, has ensued in Ukraine—and the implications of these actions.

Up until Russia's invasion, the direct targeting of NPPs was largely in the realm of the unimaginable, owing to the potentially devastating consequences for citizens and the natural environment. Scholars have underscored that the legal protections against targeting installations that contain dangerous forces are “so fundamental that they are recognized as a part of the customary international humanitarian law.”<sup>20</sup> Moreover, Russia has been a Party to AP I since 1989, and therefore it continues to be bound by the AP I prohibition on attacks on installations with dangerous forces, although it withdrew from the Article 90 International Fact-Finding Commission in 2019.<sup>21</sup> The Article also explores what other policy tools might strengthen IHL and offer other accountability mechanisms for the protection of NPPs, given the potential harm from an attack on either nonoperational or operational NPPs as well as the evolving role of the IAEA in armed conflict.

## I. Targeting Ukraine's NPPs

From February 24 until March 31, 2022, Russian forces occupied the Chornobyl NPP along with taking control of the surrounding 30-kilometer Exclusion Zone, which was established after the 1986 accident.<sup>22</sup> During this period, Russian troops also began to dig trenches in what is known as the Red Forest. Despite ongoing decommissioning and not being an operational NPP for more than 35 years, the Chornobyl NPP still contains dangerous forces; large

amounts of nuclear material remain at the site, including the spent fuel rods that are stored there.<sup>23</sup> An attack even on a nonfunctional NPP such as Chornobyl could result in damage to the spent fuel tanks, allowing radioactive particles to be carried downwind or radioactive material to contaminate the surrounding soil.<sup>24</sup>

From the first days of the war, the IAEA was monitoring the situation at the Chornobyl NPP, as there were concerns about whether the staff would be able to rotate and return to their homes in Slavutych, which is located outside the Exclusion Zone and built after the 1986 accident.<sup>25</sup> Within days, however, it became increasingly difficult for the technical staff to travel back and forth, and by February 26, 2022, Russian troops had already surrounded the city. From a safety standpoint, the rotation of staff is critical for safely managing the removal and disposal of the fuel and radioactive waste at the Chornobyl NPP as well as to continue to decommission the reactors at the Chornobyl NPP. The State Exclusion Zone Agency helps to manage and monitor the radioactive waste within the Exclusion Zone, and it became increasingly cumbersome to carry out even routine activities.<sup>26</sup>

With fighting taking place in the vicinity of the Chornobyl NPP, there was additional unease about energy disruptions that could interrupt the cooling pools for the spent fuel rods at the Chornobyl NPP. More so, while there were no radiation leaks during the month-long military occupation of the Chornobyl NPP, there were other concerns that soldiers could have disrupted “invisible hot spots” where there are high levels of cesium-137, strontium-90, and plutonium isotopes.<sup>27</sup>

In 2022, it seemed unimaginable that a State with nuclear weapons would seek to occupy an NPP, especially one that in not such distant memory had one of the world's largest nuclear calamities. In fact, the impact of the Chornobyl tragedy was seen in the growth of environmental (including anti-nuclear) movements throughout eastern Europe and the Soviet Union, many of which had played a role in toppling the Soviet regime.<sup>28</sup>

While the conflict began with occupying the Chornobyl NPP, most of the Russian attacks on NPPs have taken place in the vicinity of the Zaporizhzhia NPP, which at full operational capacity had supplied approximately 20% of

19. *E.g.*, Erika Weinthal & Jeannie Sowers, *Protracted Conflicts and Prolonged Occupations: Targeting Infrastructure and Livelihoods in the West Bank and Gaza*, 95 INT'L AFFS. 319 (2019); Sowers & Weinthal, *supra* note 16.

20. Michal Onderco & Clara Egger, *Why a New Convention to Protect Nuclear Installations in War Is a Bad Idea*, BULL. ATOMIC SCIENTISTS (Dec. 5, 2022), <https://thebulletin.org/2022/12/why-a-new-convention-to-protect-nuclear-installations-in-war-is-a-bad-idea/>.

21. The Soviet Union had previously ratified AP I. ICRC International Humanitarian Law Databases, *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, 8 June 1977—Russian Federation, <https://ihl-databases.icrc.org/en/ihl-treaties/api-1977/state-parties/ru> (last visited Feb. 5, 2023).

22. MCKENZIE INTELLIGENCE SERVICES, CHORNOBYL STUDY (2022) (commissioned by Greenpeace Germany).

23. Press Release, IAEA, Update 7—IAEA Director General Statement on Situation in Ukraine (Mar. 2, 2022), <https://www.iaea.org/newscenter/pressreleases/update-7-iaea-director-general-statement-on-situation-in-ukraine>.

24. Zeith & Giorgou, *supra* note 18.

25. Press Release, IAEA, Update 33—IAEA Director General Statement on Situation in Ukraine (Mar. 26, 2022), <https://www.iaea.org/newscenter/pressreleases/update-33-iaea-director-general-statement-on-situation-in-ukraine>.

26. Press Release, IAEA, Update 43—IAEA Director General Statement on Situation in Ukraine (Apr. 5, 2022), <https://www.iaea.org/newscenter/pressreleases/update-43-iaea-director-general-statement-on-situation-in-ukraine>.

27. Andrew E. Kramer, *Russian Blunders in Chernobyl: “They Came and Did Whatever They Wanted,”* N.Y. TIMES (Apr. 8, 2022), <https://www.nytimes.com/2022/04/08/world/europe/ukraine-chernobyl.html>.

28. *See, e.g.*, JoAnn Carmin & Adam Fagan, *Environmental Mobilisation and Organisations in Post-Socialist Europe and the Former Soviet Union*, 19 ENV'T POL. 689 (2010).

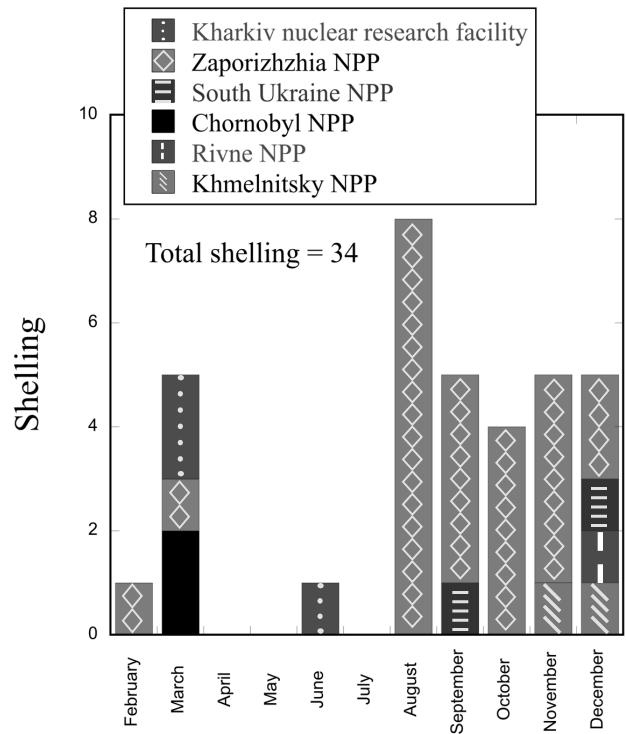
Ukraine’s electricity supply.<sup>29</sup> On March 4, 2022, Russian troops attacked and seized control of the six reactors at the Zaporizhzhia NPP in Ukraine, which is the largest NPP in Europe. Increasingly, it has been the shelling of infrastructure supporting the Zaporizhzhia NPP, including power lines and off-site electricity installations, that have amplified international consternation about the potential for a nuclear accident.<sup>30</sup>

Drawing on updates from the IAEA, Figure 1 illustrates the intensification of attacks on the Zaporizhzhia NPP beginning in August 2022 until December 2022. Notably, in early September 2022, Russian shelling destroyed the off-site electricity supply to the Zaporizhzhia NPP.<sup>31</sup> This thermal plant supplies critical power to the NPP when its normal supply lines are down, which has occurred with greater frequency owing to Russian shelling. Not only did the nearby town (Enerhodar) experience total blackouts, when the thermal supply is cut, the Zaporizhzhia NPP must rely upon its only remaining operating reactor for power for cooling and other safety functions.<sup>32</sup> Once an NPP loses access to its external power, as the last resort it must then rely upon emergency diesel generators, which have fuel for 10 days.<sup>33</sup>

Figure 1 also shows that while the Zaporizhzhia NPP and related infrastructure have borne the brunt of the shelling, other facilities containing dangerous forces have come under attack, including the Kharkiv Institute of Physics and Technology, which houses a nuclear reactor and produces radioisotopes for medical and industrial applications. Figure 1, further, shows the extent of Russian shelling on installations that contain dangerous forces.

Simply put, nuclear reactors were not built to be turned on and off during war; yet following the September 2022 wave of Russian attacks at the Zaporizhzhia NPP, Ukraine was forced to turn off its reactors there. According to *New York Times* reporting, if the plant were kept running, it could be a “prelude to a nuclear meltdown at Europe’s largest nuclear power facility.”<sup>34</sup> At that time, power unit No. 6 was shut down and the Zaporizhzhia NPP was put in a cold shutdown considered “the safest mode for the Zaporizhzhia NPP power units under the circumstances.”<sup>35</sup>

**Figure 1. Shelling in the Vicinity of NPPs**



Source: IAEA, *Press Releases*, <https://www.iaea.org/news?type=3243> (last visited Feb. 24, 2023).

Throughout the fall, however, the Zaporizhzhia NPP was repeatedly cut off from the grid owing to Russian shelling; external power is critical for maintaining the electric pumps to supply the cooling water. On October 8, the Zaporizhzhia NPP lost access to external power due to overnight shelling and was pulled off-line again. This is despite international opprobrium to avoid shelling the NPP and its environs.<sup>36</sup> Russian military attacks on Ukraine’s nuclear facilities continued to worsen such that by November 23, according to the IAEA, all of Ukraine’s NPPs, including the Rivne, South Ukraine, and Khmelnytsky NPPs, had suffered a complete loss of external power simultaneously.<sup>37</sup>

## II. Attacks on NPPs

That there are only nine countries that currently possess nuclear weapons has made it less likely that nuclear weapons would be used in war, despite the fact that several of these States have had adversarial relations.<sup>38</sup> While the end of the Cold War called into question whether the notion of mutually assured destruction would continue to be a

29. Reuters, *Zaporizhzhia on the Frontline*, <https://graphics.reuters.com/UKRAINE-CRISIS/ZAPORIZHZHIA/mypmznjqvt/> (last visited Feb. 24, 2023).

30. Press Release, IAEA, Update 114—IAEA Director General Statement on Situation in Ukraine (Oct. 8, 2022), <https://www.iaea.org/newscenter/pressreleases/update-114-iaea-director-general-statement-on-situation-in-ukraine> [hereinafter IAEA, Update 114].

31. Isobel Koshiw, *Offsite Power Supply to Zaporizhzhia*, *GUARDIAN* (Sept. 9, 2022), <https://www.theguardian.com/world/2022/sep/09/offsite-power-supply-to-zaporizhzhia-nuclear-plant-destroyed>.

32. *Id.*

33. IAEA, Update 114, *supra* note 30.

34. Marc Santora & David E. Sanger, *Ukraine Begins to Shut Down the Zaporizhzhia Nuclear Plant as a Safety Measure*, *N.Y. TIMES* (Sept. 11, 2022), <https://www.nytimes.com/2022/09/11/world/europe/zaporizhzhia-nuclear-plant-shutdown.html>.

35. *Briefing on the Environmental Damage Caused by the Russia’s War of Aggression Against Ukraine (September 8-14, 2022)*, *MINISTRY ENV’T PROT. & NAT. RES. UKR.* (Sept. 16, 2022), <https://mepr.gov.ua/en/news/39823.html>.

36. IAEA, Update 114, *supra* note 30.

37. Press Release, IAEA, Update 132—IAEA Director General Statement on Situation in Ukraine (Nov. 24, 2022), <https://www.iaea.org/newscenter/pressreleases/update-132-iaea-director-general-statement-on-situation-in-ukraine> [hereinafter IAEA, Update 132].

38. These include the United States, Russia, France, China, the United Kingdom, Pakistan, India, Israel, and North Korea.

threat, the number of nuclear powers has not proliferated,<sup>39</sup> and despite the involvement of many of these nuclear powers in other wars, especially in the Middle East, nuclear weapons have never been used and rarely have operational NPPs come under fire. Pakistan and India have, further, negotiated a non-attack agreement in 1998 (entered into force in January 1991) in which the two countries agreed to refrain from destroying or damaging each other's nuclear installations and facilities.<sup>40</sup>

Further, it has long been taken for granted that NPPs are to be safeguarded and off-limits during war. Prior to Russia's invasion of Ukraine, only a few nuclear installations have been caught in the crossfire of war—and none to date have caused substantial radioactive releases.<sup>41</sup> The first military attack on a nuclear reactor was in September 1980 when two Iranian jets dropped bombs on the Osirak nuclear reactor, which was then under construction and unfueled in Iraq.<sup>42</sup> Months later, eight Israeli jets bombed the same site in June 1981, destroying the Osirak reactor. Iraq under Saddam Hussein retaliated against Iran in a 1984 attack in which Iraqi jets sought to destroy two unfueled nuclear reactors at Bushehr, which were still under construction.<sup>43</sup>

These prior attacks on nonoperational nuclear sites were often rationalized because they were seen to rein in the ability of countries to build a nuclear bomb, especially among countries that were considered long-standing enemies/rivals. What is notable, however, was that these power plants were not yet functional—that is, they were nonoperational and thus did not (yet) contain dangerous forces. Only during the 1990-1991 Gulf War did the U.S. military during the opening days of the war target two operational nuclear reactors at the Tuwaitha site. In response, Iraq not only fired Scud missiles on Israel, but also sent five toward the Dimona nuclear reactor in the Negev, missing their target.<sup>44</sup> The most recent attack against an operational nuclear reactor took place in July 2014, when Hamas launched rockets, albeit unsuccessfully, against the Dimona reactor in Israel.<sup>45</sup>

Concern over operational reactors, even for peaceful purposes, has to do with their possession of uranium fuel, which can be diverted to atomic bomb programs,<sup>46</sup> and in part due to the potential for a nuclear accident. Russia's attacks on the Zaporizhzhia NPP, however, is the first time that a functional NPP has not only been targeted, but physically occupied, affecting adherence to international standards for nuclear and radiation safety requirements and creating risks of a nuclear accident, whether caused by direct explosion, damage to supporting infrastructure, or the inability of staff to effectively perform their responsibilities.<sup>47</sup>

### III. IHL and the Prohibition of Targeting NPPs

NPPs are emphatically protected during war. AP I, and to a lesser extent AP II and broader customary IHL applicable in international and non-international armed conflicts, provide clear protections.<sup>48</sup> Article 56(1) of AP I provides:

Works or installations containing dangerous forces, namely dams, dykes and nuclear electrical generating stations, shall not be made the object of attack, even where these objects are military objectives, if such attack may cause the release of dangerous forces and consequent severe losses among the civilian population. Other military objectives located at or in the vicinity of these works or installations shall not be made the object of attack if such attack may cause the release of dangerous forces from the works or installations and consequent severe losses among the civilian population.

Article 56(2)(b) qualifies this protection by noting that the special prohibition against attack ceases “only” if a “nuclear electrical generating station . . . provides electric power in regular, significant and direct support of military operations and if such attack is the only feasible way to terminate such support.” Thus, if electrical support to military operations could be terminated by targeting a power line, AP I would continue to prohibit attacks on an NPP, even if that plant were regularly, significantly, and directly supporting military operations.<sup>49</sup> Article 56 offers additional protections that will be considered in due course.

#### A. To Be Near or in the Vicinity of

In addition to protecting NPPs directly, Article 56 of AP I restricts fighting at or in the vicinity of a work or installation, especially those that could release dangerous forces.<sup>50</sup> Article 56(1) provides that “[o]ther military objectives located at or in the vicinity of these works or installations shall not be made

39. North Korea carried out its first underground nuclear test in 2006. See Fact Sheet, Arms Control Association, Chronology of U.S.-North Korean Nuclear and Missile Diplomacy (Apr. 2022), <https://www.armscontrol.org/factsheets/dprkchron>. Following the Cold War, Belarus, Kazakhstan, and Ukraine all dismantled their nuclear weapons. Moreover, post-Apartheid South Africa ended its nuclear weapon program.

40. Nuclear Threat Initiative, *India-Pakistan Non-Attack Agreement*, <https://www.nti.org/education-center/treaties-and-regimes/india-pakistan-non-attack-agreement/> (last updated Oct. 26, 2011).

41. William J. Broad, *Decades of Nuclear Reactor Strikes Predate Ukraine Power Plant Crisis*, N.Y. TIMES (Oct. 9, 2022), <https://www.nytimes.com/2022/10/09/science/ukraine-nuclear-power-plant-crisis.html>.

42. *Id.*

43. *Id.*; JOHN CARLSON, VIENNA CENTER FOR DISARMAMENT AND NON-PROLIFERATION, PROHIBITION OF MILITARY ATTACKS ON NUCLEAR FACILITIES (2022), [https://vcdnp.org/wp-content/uploads/2022/09/Attacks-on-nuclear-facilities\\_Carlson-updated.pdf](https://vcdnp.org/wp-content/uploads/2022/09/Attacks-on-nuclear-facilities_Carlson-updated.pdf).

44. Judah Ari Gross, *Gas Masks, Missiles and Irony: Defense Ministry Releases Photos of 1991 Gulf War*, TIMES ISR. (Jan. 6, 2021), <https://www.timesofisrael.com/gas-masks-missiles-and-irony-defense-ministry-releases-photos-of-1991-gulf-war/>.

45. CARLSON, *supra* note 43.

46. See Broad, *supra* note 41.

47. *Briefing on the Environmental Damage Caused by the Russian Invasion of Ukraine (19-22 April 2022)*, *supra* note 1.

48. Zeith & Giorgou, *supra* note 18.

49. *How Humanitarian Law Applies to Armed Conflict and Nuclear Power Plants*, ICRC (Sept. 2, 2022), <https://www.icrc.org/en/document/how-ihl-applies-to-conflict-nuclear-power-plants>.

50. Zeith & Giorgou, *supra* note 18.

the object of attack if such attack may cause the release of dangerous forces from the works or installations and consequent severe losses among the civilian population.” Similar to the analysis above for the NPP, though, these protections cease in narrow circumstances defined by Article 56(2), namely that the other military objective must be “used in regular, significant and direct support of military operations” and an attack on it must be “the only feasible way to terminate such support.”

Thus, both Russian and Ukrainian troops must avoid carrying out hostilities in the vicinity of any NPP, including the non-operational Chernobyl NPP and the operational Zaporizhzhia NPP.<sup>51</sup> The 34 shelling incidents strongly suggest Russian intention or willful disregard for the prohibitions on attacks in the vicinity of NPPs. Moreover, while Figure 1 above captures shelling in the vicinity of the Zaporizhzhia NPP according to IAEA updates, it does not capture low-flying missiles near the Zaporizhzhia NPP. In April 2022, multiple missiles flew close to the Zaporizhzhia NPP, with several landing in the town of Zaporizhzhia.<sup>52</sup> Similarly, the Ministry of Environmental Protection and Natural Resources of Ukraine reported that on June 5, 2022, and June 26, 2022, Russian cruise missiles flew extremely low over the South Ukraine NPP.<sup>53</sup>

Parties have an obligation to avoid making NPPs military objectives. Accordingly, under Article 56(5), “Parties to the conflict shall endeavour to avoid locating any military objectives in the vicinity of” NPPs and other installations containing dangerous forces. Thus, States Parties are obligated to avoid locating military objectives at or in the vicinity of NPPs, especially to use an NPP as a staging ground from which to fight, as this would amplify the potential for the release of dangerous forces.

Until Russia’s invasion of Ukraine, NPPs had never been used as platforms for launching missile attacks, which is a clear illegal action. Ukrainian reports have noted that Russia has been using the Zaporizhzhia NPP as a staging ground to carry out artillery strikes.<sup>54</sup> Article 56(5) of AP I allows for the placement of some military installations in the vicinity of an NPP, “for the sole purpose of defending the protected works or installations from attack.” It does not permit, however, the use of an NPP as a regular base for launching missiles—an action that could increase the risk that fighting might take place near the NPP. Similarly, using the Chernobyl NPP as a staging base for military operations violates Article 56(5) of AP I.

Experience with the Russian targeting of infrastructure related to the NPPs highlights certain ambiguities in the defi-

nition of what constitutes “in the vicinity of” an NPP. For example, in late December 2022, the Zaporizhzhia NPP’s six reactors were all in shutdown, only receiving off-site electricity necessary for cooling the reactor and other essential purposes; Russian shelling on December 29 cut off the last functioning backup line, located on the other side of the Dnipro River, which the IAEA described as “some distance away from the plant itself.”<sup>55</sup> While the IAEA noted that the shelling did not directly hit the NPP, many of the thermal power stations are located along the Dnipro River, and thus to protect an NPP during armed conflict, this might entail broadening the definition of “in the vicinity of” to mean infrastructure and personnel necessary to support the workings of an NPP. The expanded definition would be warranted due to the serious risks to the civilian population of a catastrophic failure of an NPP—one that would be caused by the lack of electricity to keep the rods cool.

Another example of the ambiguity of “in the vicinity of” pertains to the essential electricity and water infrastructure for the cooling of the reactors and the spent fuel rods, such as dams, which may not be in the physical vicinity of the NPP. Thus, while much attention has focused on threats to the power supply to the Zaporizhzhia NPP, in October 2022, the international community/news outlets turned to the Nova Kakhovka Dam, a hydroelectric dam in the southern port city of Kherson, which is also the last major crossing over the Dnipro River that has allowed Russian soldiers to sustain their presence there. This dam has strategic importance because if the Ukrainians were to retake the dam, Russian soldiers would be left with the choice of immediately retreating or being largely surrounded.

Yet, the collapse of the dam would also have reverberating effects for the Zaporizhzhia NPP, as it provides water for the cooling functions of the NPP. If Russia were to blow up the dam, it would not only flood 80 towns, villages, and cities, including Kherson, but cause unprecedented issues for the operations of the power plant.<sup>56</sup> With approximately 150 kilometers between the Zaporizhzhia NPP and the Nova Kakhovka Dam, the dam is not physically near the Zaporizhzhia NPP, but, as has become increasingly evident, infrastructure, including electric power plants, water systems, and nuclear power installations, must be understood to be more complex and dependent upon inputs that may not be in the vicinity, just as they have reverberating effects across different systems.

## B. To Occupy

In addition to governing conduct during armed conflict, IHL—and particularly the law of occupation—applies to territories partially or completely occupied by soldiers from

51. *Id.*

52. Steven Mufson & David L. Stern, *IAEA Finds Normal Radioactivity at Chernobyl on Disaster’s Anniversary*, WASH. POST (Apr. 26, 2022), <https://www.washingtonpost.com/climate-environment/2022/04/26/chernobyl-nuclear-anniversary-radioactivity-inspectors/>.

53. *Briefing on the Environmental Damage Caused by the Russia’s War of Aggression Against Ukraine (2-8 June 2022)*, MINISTRY ENV’T PROT. & NAT. RES. UKR. (June 10, 2022), <https://mepr.gov.ua/en/news/39274.html>; *Briefing on the Environmental Damage Caused by the Russia’s War of Aggression Against Ukraine (23-29 June 2022)*, MINISTRY ENV’T PROT. & NAT. RES. UKR. (July 1, 2022), <https://mepr.gov.ua/en/news/39368.html>.

54. *Briefing on the Environmental Damage Caused by the Russia’s War of Aggression Against Ukraine (July 28-August 3, 2022)*, MINISTRY ENV’T PROT. & NAT. RES. UKR. (Aug. 5, 2022), <https://mepr.gov.ua/en/news/39470.html>.

55. Press Release, IAEA, Update 138—IAEA Director General Statement on Situation in Ukraine (Dec. 30, 2022), <https://www.iaea.org/newscenter/pressreleases/update-138-iaea-director-general-statement-on-situation-in-ukraine>.

56. Marc Santora, *The Nova Kakhovka Dam Looms Large in the Possible Battle for Kherson*, N.Y. TIMES (Oct. 26, 2022), <https://www.nytimes.com/live/2022/10/26/world/russia-ukraine-war-news>.

another country—in this case, the Russian Federation.<sup>57</sup> The law of occupation, sometimes referred to as the Fourth Geneva Convention, provides that the occupying force must protect the welfare of the people living in the occupied territory.

Russia has occupied parts of Ukraine—namely, the Donbas and Crimea—since 2014. Between 2017 and March 2021, the U.N. Children’s Fund (UNICEF) documented 380 attacks on water infrastructure in the Donbas region, putting children at risk from outbreaks of waterborne diseases.<sup>58</sup> As of December 2022, UNICEF found that because of Russian attacks on energy infrastructure, almost every child in Ukraine—approximately seven million—is without access to not only electricity, but also water, further heightening concern about waterborne diseases and risks of pneumonia, seasonal influenza, and COVID-19.<sup>59</sup>

From the start of its 2022 invasion, the Russian military has stationed its troops in the vicinity of and even within the Chernobyl and Zaporizhzhia NPPs. From February 24, 2022, until April 2, 2022, Russian troops took control of the Chernobyl NPP; since March 4, 2022, Russian troops have taken control of the Zaporizhzhia NPP. In the latter case, according to the Ministry of Environmental Protection and Natural Resources of Ukraine, Russian troops “opened artillery fire at reactor Unit 1 and [an] administrative building” as it entered the site.<sup>60</sup>

The Russian army has endangered the operations of the NPPs, and the Ukrainians living in the area, by placing heavy weapons near the plants, including rocket launch systems. In April, Russian troops brought heavy military equipment into the turbine halls of Units 1 and 2 of the Zaporizhzhia NPP.<sup>61</sup> This heavy military equipment, according to the Ministry of Environmental Protection and Natural Resources of Ukraine, has blocked access to the power unit’s firefighting equipment, especially in the engine room, creating unnecessary risks to safety protocols.<sup>62</sup> By August, it was reported that Russian troops had increased the amount of heavy military equipment at the Zaporizhzhia NPP with 16 military vehicles located near power Unit 1 and seven military vehicles near Unit 2.<sup>63</sup>

Not only do NPPs require water for cooling, but they also comprise skilled labor, who despite being trained in different emergency scenarios, are still vulnerable to human error, especially if physically and mentally overtaxed.<sup>64</sup> Because workers have been unable to rotate shifts, the IAEA has repeatedly highlighted in its updates the stressful working conditions that the staff are experiencing to maintain the proper functions of the NPPs.

If not undertaken with due care, the occupation of an NPP not only threatens the safety of the staff employed in the power plant, but also the broader population. As the 1986 Chernobyl nuclear accident illustrated, the serious effects to public health and the environment can extend across national boundaries.

International condemnation has focused on the shelling of NPPs and nearby objects; yet, months of siege have created other risks that could have long-term health and environmental impacts if staff are unable to carry out their day-to-day functions. In many other wars, infrastructure has deteriorated and become nonfunctional owing to the inability of staff to work, staff fleeing war, and lack of supplies for repairs—as has been the case for many desalination, water treatment, and sewage treatment plants in the wars in the Middle East and North Africa. War in Libya has resulted in the failure of sewage treatment facilities such that untreated sewage flows directly into the Mediterranean.<sup>65</sup> In Iraq, the Mosul Dam—the fifth largest dam worldwide—was at risk of collapse owing to the lack of routine maintenance due to the absence of staff who had fled in 2014 following the takeover by the Islamic State.<sup>66</sup>

Yet, when it comes to NPPs, the indirect effects of occupying and shelling an NPP are amplified, especially if staff that are responsible for monitoring contamination are unable to do their jobs. For example, the Ministry of Environmental Protection and Natural Resources of Ukraine reported that on July 18, 2022, Russian troops had abducted Serhiy Pikhtin, the deputy head of the Department of Decontamination and Radioactive Waste Management, along with Olena Ryabtseva, a specialist in the Decontamination Department.<sup>67</sup> Russian troops, moreover, have not followed established rules regarding the use of special protective clothing, further complicating the ability of staff to maintain safety within the NPPs, including concerns about spreading radiation particles from their clothes.<sup>68</sup> NPPs, thus, must be protected not only to prevent a radiation leak, but so that staff can access the plants to perform their routine tasks.<sup>69</sup>

Even after Russian troops left the Chernobyl NPP, the impacts of their presence remained, owing to the extensive looting of equipment, which included 698 computers, 1,500 dosimeters, software required to control the radiation level,

57. While IHL applies during armed conflict, one could argue that Ukraine has experienced protracted conflict since 2014, albeit at times without active hostilities, and thus the law of occupation also applies.

58. UNICEF, *WATER UNDER FIRE VOLUME 3: ATTACKS ON WATER AND SANITATION SERVICES IN ARMED CONFLICT AND THE IMPACTS ON CHILDREN* (2021).

59. Press Release, UNICEF, *Almost Seven Million Children in Ukraine at Risk as Attacks on Energy Infrastructure Cause Widespread Blackouts and Disruption of Heating and Water* (Dec. 14, 2022), <https://www.unicefusa.org/press/releases/almost-seven-million-children-ukraine-risk-attacks-energy-infrastructure-cause>.

60. *Record of Environmental Damage Inflicted by Russian Aggression in Ukraine as of 14 March 2022*, MINISTRY ENV’T PROT. & NAT. RES. UKR. (Mar. 15, 2022), <https://mepr.gov.ua/en/news/39034.html>.

61. IAEA, *NUCLEAR SAFETY, SECURITY, AND SAFEGUARDS IN UKRAINE: 2ND SUMMARY REPORT BY THE DIRECTOR GENERAL*, 28 APRIL-5 SEPTEMBER 2022 (2022), [https://www.iaea.org/sites/default/files/22/09/ukraine-2nd-summaryreport\\_sept2022.pdf](https://www.iaea.org/sites/default/files/22/09/ukraine-2nd-summaryreport_sept2022.pdf).

62. *Briefing on the Environmental Damage Caused by the Russia’s War of Aggression Against Ukraine (14-20 July 2022)*, MINISTRY ENV’T PROT. & NAT. RES. UKR. (July 22, 2022), <https://mepr.gov.ua/en/news/39440.html>.

63. *Briefing on the Environmental Damage Caused by the Russia’s War of Aggression Against Ukraine (August 18-24, 2022)*, MINISTRY ENV’T PROT. & NAT. RES. UKR. (Aug. 27, 2022), <https://mepr.gov.ua/en/news/39615.html>.

64. Elisabeth Swaton et al., *Human Factors in the Operation of Nuclear Power Plants: Improving the Way Man and Machines Work Together*, 4 IAEA BULL. 27 (1987).

65. Interview with humanitarian representative, Geneva, Switz. (Oct. 2022).

66. Rene Nijenhuis, *On the Humanitarian and Environmental Frontline in Iraq*, U.N. ENV’T PROGRAMME (July 26, 2016), <https://www.unep.org/news-and-stories/story/humanitarian-and-environmental-frontline-iraq>.

67. *Briefing on the Environmental Damage Caused by the Russia’s War of Aggression Against Ukraine (14-20 July 2022)*, *supra* note 62.

68. *Id.*

69. Zeith & Giorgou, *supra* note 18.

as well as nearly all the firefighting equipment.<sup>70</sup> Ultimately, while the looting of an NPP is not a direct military attack, it does impair the workings of an NPP that still contains dangerous forces, putting at risk the workers and neighboring communities—all of which is a violation of the law of occupation.

### C. *The Foreseeable, but Unknown*

Because modern infrastructure is highly integrated and complex, especially infrastructure that supports urban environments and industry, Mark Zeitoun and Michael Talhami have shown that targeting energy infrastructure has a multiplicity of reverberating effects for civilians.<sup>71</sup> For example, the impacts are wide-reaching if an electric power plant is destroyed: the loss of energy will undercut the ability to treat drinking water and sanitation and the provision of medical care.

Thus, while we know the range of indirect effects that might ensue from attacking a conventional power plant, the indirect effects of destroying an NPP or causing a catastrophic accident, while foreseeable, are largely unknown due primarily to the geographic scale and the long timelines (particularly those effects to the soil, wildlife, and human health that may only be ascertained decades after an incident), as well as the potential for reverberating effects driven by these larger and longer impacts. For example, owing to the release of radioactive materials and the exposure of workers involved in the cleanup at the Chernobyl NPP, the World Health Organization (WHO) carried out a health assessment two decades after the accident in which they found higher cases of thyroid cancer in individuals exposed in childhood.<sup>72</sup>

The Chernobyl nuclear accident provides a lens into what might follow a nuclear accident.<sup>73</sup> In many ways, because the first few weeks of the war took place in the Chernobyl Exclusion Zone, as Russian soldiers were digging trenches in the Red Forest, stirring up radioactive dust, memories of the Chernobyl accident were reawakened. As Russia's attacks on Ukraine's energy sector, including the nuclear sector, continued into the winter and for the first time in November 2022 with the simultaneous loss of off-site power at all of Ukraine's NPPs, Director General Rafael Mariano Grossi of the IAEA remarked, "This would have been completely unimaginable before this tragic war."<sup>74</sup> On November 20, 2022, repeated Russian shelling took place at the site of the Zaporizhzhia NPP, damaging buildings, systems, and equipment.<sup>75</sup>

## IV. Protecting the Atom

As in many conflicts, a network of humanitarian, international, and national actors toil to protect civilians from the harmful impacts of war. Yet, owing to the special status of NPPs—they are both civilian objects and they contain dangerous forces—this is one of the first wars in which the IAEA has assumed a pronounced role—that is, one that veers from its original mandate to harness "Atoms for Peace" within the U.N. system.

Article II of the IAEA's statute calls for working with Member States to "accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world."<sup>76</sup> Promoting and controlling the atom as defined in Article II of its statute did not explicitly include or otherwise address the shelling of NPPs. Rather, the IAEA is supposed to "establish and administer safeguards to ensure that [nuclear technology and materials] . . . are not used in such a way as to further any military purpose."<sup>77</sup>

While much has been written about the origins of the IAEA during the Cold War and its role in weapons inspections in Iraq prior to the 2003 Gulf War, the IAEA has never had to insert itself into the middle of an ongoing war to protect an NPP and its staff from repeated attacks. Simply put, the IAEA was not designed to prevent the targeting of NPPs during war.<sup>78</sup>

But within weeks after Russia invaded Ukraine, IAEA Director General Grossi sought to travel to the Chernobyl NPP to ensure that all parties were committed to the safety and security of the NPP.<sup>79</sup> On March 4, 2022, Director General Grossi underscored that the "IAEA is the international, authoritative technical nuclear agency capable of providing the adequate technical assistance to help ensure the safe and secure operation of nuclear facilities."<sup>80</sup> This was largely in response to the IAEA losing its connection to the Chernobyl NPP following Russia's occupation of the NPP, such that data from automated radiation monitoring stations could not reach the IAEA.<sup>81</sup>

Russia's shelling of Ukraine's NPPs and interference with the normal workings of the NPPs has compelled the IAEA to take a more aggressive position in Ukraine to protect the atom and prevent a nuclear calamity. On March 2, 2022, the IAEA announced a set of seven principles or "indispensable pillars"

70. *Briefing on the Environmental Damage Caused by the Russia's War of Aggression Against Ukraine (2-8 June 2022)*, *supra* note 53.

71. Mark Zeitoun & Michael Talhami, *The Impact of Explosive Weapons on Urban Services: Direct and Reverberating Effects Across Space and Time*, 98 INT'L REV. RED CROSS 53 (2016).

72. WHO, HEALTH EFFECTS OF THE CHERNOBYL ACCIDENT AND SPECIAL HEALTH CARE PROGRAMMES: REPORT OF THE UN CHERNOBYL FORUM EXPERT GROUP "HEALTH" (Burton Bennett et al. eds., 2006).

73. KATE BROWN, MANUAL FOR SURVIVAL: AN ENVIRONMENTAL HISTORY OF THE CHERNOBYL DISASTER (2019).

74. IAEA, Update 132, *supra* note 37.

75. Press Release, IAEA, Update 129—IAEA Director General Statement on Situation in Ukraine (Nov. 20, 2022), <https://www.iaea.org/newscenter/pressreleases/update-129-iaea-director-general-statement-on-situation-in-ukraine>.

76. IAEA STAT. art. II (1989), <https://www.iaea.org/sites/default/files/statute.pdf>. For historical perspectives on the creation of the IAEA, see PAUL C. SZASZ, THE LAW AND PRACTICES OF THE INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA Legal Series No. 7, 1970); Elisabeth Roehrlich, *The Cold War, the Developing World, and the Creation of the International Atomic Energy Agency (IAEA)*, 1953-1957, 16 COLD WAR HIST. 195 (2016).

77. IAEA STAT. art. III(A)(5) (1989).

78. Anthony Burke, *Attacks on Ukrainian Nuclear-Power Plants Challenge Treaties*, NATURE (Nov. 4, 2022), <https://www.nature.com/articles/d41586-022-03580-0>.

79. Press Release, IAEA, IAEA Director General Grossi's Initiative to Travel to Ukraine (Mar. 4, 2022), <https://www.iaea.org/newscenter/pressreleases/iaea-director-general-grossi-initiative-to-travel-to-ukraine> [hereinafter IAEA Director General Grossi's Initiative to Travel to Ukraine].

80. *Id.*

81. The connection between the Chernobyl NPP and the State Nuclear Regulatory Inspectorate of Ukraine was restored on April 19 and then also with the IAEA. *Briefing on the Environmental Damage Caused by the Russian Invasion of Ukraine (19-22 April 2022)*, *supra* note 1.



necessary to ensure nuclear safety and security during the war in Ukraine:

1. The physical integrity of the facilities—whether it is the reactors, fuel ponds, or radioactive waste stores—must be maintained;
2. All safety and security systems and equipment must be fully functional at all times;
3. The operating staff must be able to fulfil their safety and security duties and have the capacity to make decisions free of undue pressure;
4. There must be secure off-site power supply from the grid for all nuclear sites;
5. There must be uninterrupted logistical supply chains and transportation to and from the sites;
6. There must be effective on-site and off-site radiation monitoring systems and emergency preparedness and response measures; and
7. There must be reliable communications with the regulator and others.<sup>82</sup>

Only in early September 2022 did IAEA inspectors gain access to the Zaporizhzhia NPP<sup>83</sup>; yet, according to the Ministry of Environmental Protection and Natural Resources of Ukraine, the Russian military stationed at the NPP sought to impede communications between the station employees and members of the IAEA mission.<sup>84</sup>

In the next section, we discuss other policy and legal mechanisms that may be necessary to protect NPPs during war. It is also apparent that the IAEA will play a more prominent role in developing policy and legal mechanisms, as it possesses both the technical know-how and scientific expertise to ensure that NPPs are protected during armed conflict.

## V. Rethinking the Protection of NPPs and IHL During War

This Article has sought to demonstrate how Russia has weaponized Ukraine's NPPs. Since February 2022, Russia has directly targeted and misused Ukraine's NPPs and related critical infrastructure to try to extend its authority over the territory and population of Ukraine. What is striking, though, about the war in Ukraine is that belligerents who seek to occupy and control territory usually do not seek to fully destroy infrastructure, but rather to only partially damage infrastructure (often in a limited way) so that they can quickly and easily rebuild and use it as a tool to control populations and territory, as well as providing

for their soldiers.<sup>85</sup> Yet, this type of weaponization of infrastructure has not played out in Ukraine; rather, because Russian troops have suffered severe defeats over the past few months, it is increasingly apparent that Russia's tactics are to lay waste to infrastructure to punish civilians—a clear violation of IHL.

There are some historic examples of retreating armies conducting scorched-earth tactics that destroyed infrastructure. Where these scorched-earth tactics were for a legitimate military purpose (such as providing cover or depriving a pursuing army of supplies), IHL has often allowed such actions; in contrast, where scorched-earth tactics were aimed at harming civilians, the environment, and the economy, IHL has held leaders to account.<sup>86</sup> There are no examples of scorched-earth tactics that affected NPPs, but the special protections enjoyed by NPPs make it difficult to contemplate how scorched-earth tactics affecting NPPs would ever be allowed under international law.

While one can argue that Russia is following a similar playbook to its tactics in Chechnya and later in Syria,<sup>87</sup> the weaponization of NPPs in the Ukraine war threatens to turn what has often been considered the peaceful atom into a potentially powerful weapon—one that could indiscriminately affect large swaths of civilian populations inside and potentially outside Ukraine. Attacks on Ukraine's NPPs have heightened global concern about the potential release of radioactive substances into the surrounding environments.<sup>88</sup> The weaponization of nuclear power has further highlighted weaknesses of IHL, despite its applicability and heightened relevance, both to compel and to prevent certain actions. Thus, while humanitarian organizations must continue to call for belligerents to respect IHL, ultimately, the global community will need additional political tools to protect NPPs and related installations from being targeted during war, as with the IAEA developing its seven indispensable pillars of nuclear safety and security.

Despite the clear applicability and relevance of IHL protections, international condemnation, and IAEA efforts to reduce potential and actual harms around the NPPs in Ukraine, the repeated violations of IHL by Russian military operations in Ukraine raises serious questions about the utility of IHL, particularly against a powerful country (and a Member of the U.N. Security Council at that). IHL requires militaries to consider foreseeable harms of their actions and to take appropriate precautionary measures to prevent those harms. The long shadow of the 1986 Chernobyl accident illustrates the poten-

82. IAEA Director General Grossi's Initiative to Travel to Ukraine, *supra* note 79.

83. Press Release, IAEA, Update 97—IAEA Director General Statement on Situation in Ukraine (Sept. 3, 2022), <https://www.iaea.org/newscenter/pressreleases/update-97-iaea-director-general-statement-on-situation-in-ukraine>.

84. *Briefing on the Environmental Damage Caused by the Russia's War of Aggression Against Ukraine (August 25-31, 2022)*, MINISTRY ENV'T PROT. & NAT. RES. UKR. (Sept. 2, 2022), <https://mepr.gov.ua/en/news/39684.html>.

85. Daoudy, *supra* note 3. This is supplemented by conversations with staff from various humanitarian organizations who have worked in the Middle East and North Africa.

86. Anne-Cecile Vialle et al., *Peace Through Justice: International Tribunals and Accountability for Wartime Environmental Damage*, in GOVERNANCE, NATURAL RESOURCES, AND POST-CONFLICT PEACEBUILDING 665 (Carl Bruch et al. eds., Routledge 2016).

87. Erika Weinthal & Jeannie Sowers, *The Environmental and Health Dimensions of the Ukraine War*, UC PRESS BLOG (Mar. 16, 2022), <https://www.ucpress.edu/blog/58701/the-environmental-and-health-dimensions-of-the-ukraine-war/>.

88. George M. Moore, *Why the World Must Protect Nuclear Reactors From Military Attacks. Now*, BULL. ATOMIC SCIENTISTS (Dec. 15, 2022), <https://thebulletin.org/2022/12/why-the-world-must-protect-nuclear-reactors-from-military-attacks-now/>.

tial environmental, public health, and economic impacts of a nuclear catastrophe.

This conflict has seen Russian soldiers attacking, occupying, and mismanaging the nonoperational (but still dangerous) Chernobyl NPP and the even larger operational Zaporizhzhia NPP. It has even seen repeated missile launches from an NPP. All these actions are governed by IHL, including API to which Russia is a State Party. In addition to the clear prohibitions that have been violated (noted above), it is important to note that the legacy of Chernobyl means that the impacts of shelling an NPP or targeting supporting electric infrastructure have many easily foreseeable risks.

The International Committee of the Red Cross (ICRC) Guidelines on the Protection of the Natural Environment in Armed Conflict further sought to clarify the linkages between the release of dangerous forces and the devastating contamination of the surrounding land and water resources.<sup>89</sup> The impacts for civilians and the natural environment could be even more damaging than attacks on a conventional power plant, as the release of radiation can cause life-threatening harm to populations for many generations. Such concern was emphatically emphasized by IAEA Director General Grossi on March 4: “But we cannot rely on this good fortune to continue. It is high time to stop an armed conflict from putting nuclear facilities at severe risk, potentially endangering the safety of people and the environment in Ukraine and beyond. Words must mean something—it is time for action.”<sup>90</sup>

The failure of Russia to adhere to IHL has generated questions regarding whether new law is needed. Because IHL does prohibit attacks on nuclear installations,<sup>91</sup> Michal Onderco and Clara Egger suggest that “a new convention could add undesirable complexity with countries picking and choosing their commitments, which ultimately would weaken existing protections.”<sup>92</sup> Their argument is premised upon the notion that “fragmentation is dangerous.”<sup>93</sup> Moreover, there is currently little international support for negotiating new international agreements.

It is worth unpacking the fragmentation issue. The 2022 ILC Principles on Protection of the Environment in Relation to Armed Conflicts drew upon multiple bodies of international law, including IHL, international human rights law, international environmental law, international criminal law, and international trade law. This reflects a growing trend in international law away from fragmentation and toward a more holistic, integrated, and comprehensive body of law.<sup>94</sup>

The international community could seek to protect the environment both during armed conflict and in the absence of armed conflict by drawing upon multiple tools to hold belligerents accountable and ultimately preventing direct attacks on NPPs that possess dangerous forces. While recognizing the substantive differences, the field of global environmental politics has demonstrated the importance of the creation of a regime complex for addressing environmental problems such as climate change whereby “loosely coupled sets of specific regimes” reinforce one another.<sup>95</sup>

Already owing to Russia’s invasion and its destruction of infrastructure and the natural environment, Russia has failed to meet its own obligations under a number of international environmental agreements, such as the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, the Convention on Wetlands of International Importance Especially as Waterfowl Habitats (the Ramsar Convention), and the Convention on the Protection of the Black Sea Against Pollution.<sup>96</sup> Moreover, the international community could support declarations and principles committing States to protect NPPs, both operational and those that may be decommissioned, but still contain dangerous forces, like the Political Declaration on Strengthening the Protection of Civilians From the Humanitarian Consequences Arising From the Use of Explosive Weapons in Populated Areas (signed by 80 States).<sup>97</sup>

Additionally, there is a need to recognize that NPPs depend on infrastructure that may not be understood to be in close vicinity/proximity to an NPP. Regarding the protection of water installations during armed conflict, the Geneva Water Hub led the development of the Geneva List of Principles on the Protection of Water Infrastructure.<sup>98</sup> The Geneva List could be bolstered to underscore the integrated nature of infrastructure along the lines of what other fields have described as a water-energy nexus. Specifically, energy infrastructure depends on water as an input for extraction and production and likewise water systems (e.g., treatment) require energy to function; the generation of nuclear energy and decommissioning of NPPs require both energy and water.<sup>99</sup> Alternatively, a similar process could develop a new list of international legal provisions spelling out the protections for NPPs and related infrastructure.

89. ICRC, GUIDELINES ON THE PROTECTION OF THE NATURAL ENVIRONMENT IN ARMED CONFLICT: RULES AND RECOMMENDATIONS RELATING TO THE PROTECTION OF THE NATURAL ENVIRONMENT UNDER INTERNATIONAL LAW WITH COMMENTARY (2020).

90. IAEA Director General Grossi’s Initiative to Travel to Ukraine, *supra* note 79.

91. Zeith & Giorgou, *supra* note 18.

92. Onderco & Egger, *supra* note 20.

93. *Id.*

94. Carl Bruch et al., *Armed Conflict and the Environment*, in THE OXFORD HANDBOOK OF INTERNATIONAL ENVIRONMENTAL LAW 865 (Lavanya Rajamani & Jacqueline Peel eds., Oxford Univ. Press 2d ed. 2021); U.N. ENVIRONMENT PROGRAMME, PROTECTING THE ENVIRONMENT DURING ARMED CONFLICT: AN INVENTORY AND ANALYSIS OF INTERNATIONAL LAW (2009).

95. Robert O. Keohane & David G. Victor, *The Regime Complex for Climate Change*, 9 PERSPS. ON POL. 7 (2011).

96. The Ministry of Environmental Protection and Natural Resources of Ukraine requested in March 2022 that Russia be suspended from relevant multilateral environmental agreements and their governing bodies. *Ukraine Demands That Russia Be Suspended From Multilateral Environmental Agreements and Their Governing Bodies*, MINISTRY ENV’T PROT. & NAT. RES. UKR. (Mar. 4, 2022), <https://mepr.gov.ua/en/news/39009.html>.

97. Political Declaration on Strengthening the Protection of Civilians From the Humanitarian Consequences Arising From the Use of Explosive Weapons in Populated Areas (2022), <https://www.dfa.ie/media/dfa/our-role/policies/peaceandsecurity/ewipa/EWIPA-Political-Declaration-Final-Rev-25052022.pdf>.

98. Geneva Water Hub, *The Geneva List of Principles on the Protection of Water Infrastructure*, <https://www.genevawaterhub.org/resource/geneva-list-principles-protection-water-infrastructure> (last visited Feb. 5, 2023).

99. AVNER VENGOSH & ERIKA WEINTHAL, WATER QUALITY IMPACTS OF THE ENERGY-WATER NEXUS (2022).

International actors, including international humanitarian and U.N. organizations, have demonstrated elevated concern because in this case “one party has nuclear weapons.”<sup>100</sup> It may be that it is time for the international community to initiate new talks regarding a new global agreement, or additional bilateral agreements like that between India and Pakistan, to protect nuclear installations and facilities during war. Other treaties currently exist to establish nuclear-weapon-free zones, such as on the African continent with the Pelindaba Treaty, which entered into force on July 15, 2009.<sup>101</sup> Article 11 of the Pelindaba Treaty explicitly prohibits attacks on nuclear installations in the African nuclear-weapon-free zone; the treaty further requires that any nuclear material only be used for peaceful purposes.

These treaties reinforce IHL by underscoring the essential importance of protecting NPPs during armed conflict owing to the potential release of dangerous forces. Compliance with these agreements and provisions of international law can undergird support for the protection of installations containing dangerous forces, including NPPs. At the same time, there are similar challenges to enforcing compliance with these agreements as with AP I and the U.N. Charter (which are higher-profile).

The real challenge is not that international law is unclear or that it does not apply normatively. The challenge is in enforcing international law against a superpower and a Member of the U.N. Security Council. Following the 1990-1991 Gulf War, the U.N. Security Council held Iraq liable for all damage (including to the environment, natural resources, property, and public health, among other damage) arising from the war due to its illegal invasion that violated Article II, paragraph 4 of the U.N. Charter, which prohibits aggressive warfare.<sup>102</sup> As such, liability was both asserted and enforced by the Security Council, with the precise amount of damages ultimately adjudicated by the U.N. Compensation Commission.<sup>103</sup> This option is not available to address the war in Ukraine, as Russia possesses a veto on the Security Council and as such can unilaterally prevent the Security Council from taking any action.

The ICJ is another problematic option. First, Russia does not recognize the compulsory jurisdiction of the ICJ. In a case brought by Ukraine alleging Russian abuse of the Genocide Convention to justify the invasion, the ICJ found that it had jurisdiction over Russia due to the court’s jurisdiction regarding disputes related to the Genocide Convention and, following an expedited process, issued three provisional measures:

1. Russia must immediately suspend the military operations launched in Ukraine on February 24.

2. Russia must ensure that any military or irregular armed units directed or supported by it, and any organizations and persons under its control, take no steps to advance the military operations.
3. Both parties must “refrain from any action which might aggravate or extend the dispute before the Court or make it more difficult to resolve.”<sup>104</sup>

Enforcement of the ICJ’s decision has proven problematic, as that is the purview of the U.N. Security Council.

IHL legal experts have noted that “[u]nder certain conditions, launching an attack against a nuclear power plant may constitute a war crime.”<sup>105</sup> For example, attacking an NPP as a form of reprisal is prohibited. While there has been little success to date in prosecuting war crimes against the natural environment,<sup>106</sup> the deliberate destruction of an NPP that could cause severe damage to water and soil resources for generations might be considered severe enough to warrant consideration by the International Criminal Court (ICC).

Russia’s invasion of Ukraine and attacks on NPPs and facilities that contain dangerous forces requires not only greater enforcement of IHL, but mechanisms set up to investigate the violations of IHL and other war crimes against the natural environment. Ukraine has already established a special ecological inspectorate to collect evidence of environmental damage that should provide the basis for enhancing accountability for Russia’s deliberate targeting of NPPs and other infrastructure, which will have nefarious environmental and health impacts for the short and medium term.<sup>107</sup>

In March 2022, the ICC, at the request of 39 countries, commenced investigations into potential war crimes, crimes against humanity, and genocide committed in Ukraine from November 21, 2013, onward.<sup>108</sup> This includes acts related to the invasion and ongoing occupation of Crimea. In contrast to the ICJ, which applies to States, the ICC has jurisdiction over individuals. As such, the primary challenges with the ICC are (1) capturing or otherwise securing custody of the violators, and (2) the lack of effective financial remedies to compensate for or remediate violations. As more cases are brought before the ICC, though, its credibility and deterrent effect grow.

Perhaps the most promising option for holding Russia accountable for its violations of international law in Ukraine is

100. Interview with IHL experts, Geneva, Switz. (Oct. 2022).

101. U.N. Platform for Nuclear-Weapon-Free Zones, *Treaty of Pelindaba*, <https://www.un.org/nw/z/content/treaty-pelindaba> (last visited Feb. 5, 2023).

102. Cymie R. Payne, *Legal Liability for Environmental Damage: The United Nations Compensation Commission and the 1990-1991 Gulf War*, in GOVERNANCE, NATURAL RESOURCES, AND POST-CONFLICT PEACEBUILDING, *supra* note 86, at 719.

103. *Id.*; GULF WAR REPARATIONS AND THE UN COMPENSATION COMMISSION: ENVIRONMENTAL LIABILITY (Peter H. Sand & Cymie Payne eds., 2011).

104. Allegations of Genocide Under the Convention on the Prevention and Punishment of the Crime of Genocide (Ukr. v. Russ.), Order (Mar. 16, 2022), <https://www.icj-cij.org/public/files/case-related/182/182-20220316-ORD-01-00-EN.pdf>. The ICJ decision was 13-2, with the Russian and Chinese judges voting against the first two provisional measures.

105. Zeith & Giorgou, *supra* note 18. It is worth noting that the testing of nuclear weapons and other nuclear accidents in the Soviet Union has caused widespread environmental and public health harms, but addressing this form of civilian harm would fall under other aspects of international and national law.

106. ICRC, *supra* note 89; Vialle et al., *supra* note 86.

107. Louise Guillot, *How Ukraine Wants to Make Russia Pay for War’s Environmental Damage*, POLITICO (June 14, 2022), <https://www.politico.eu/article/how-ukraine-want-make-russia-pay-for-war-environmental-damage/>.

108. *Statement of ICC Prosecutor, Karim A.A. Khan QC, on the Situation in Ukraine: Receipt of Referrals From 39 States Parties and the Opening of an Investigation*, ICC (Mar. 2, 2022), <https://www.icc-cpi.int/news/state-ment-icc-prosecutor-karim-aa-khan-qc-situation-ukraine-receipt-referrals-39-states>.

the creation of a special tribunal, along the lines of the Nuremberg Tribunals. Ukraine has called for such a tribunal,<sup>109</sup> as have the president of the European Commission and the German foreign minister.<sup>110</sup> Some proposals focus on holding the Russian leaders of the invasion personally (i.e., criminally) accountable,<sup>111</sup> while others seek to use seized Russian state assets to provide a measure of compensation and support recovery.<sup>112</sup> Proposals are rooted in different bodies of law: Ukrainian law (which, since 2001, has recognized the crime of ecocide),<sup>113</sup> U.N. Charter (likely through the U.N. General Assembly), or a third party's law.<sup>114</sup> Discussions are ongoing.

In support of these accountability measures, both Ukraine and the international community have undertaken a variety of measures to collect evidence of war-related damage (especially damage to the environment and to infrastructure).<sup>115</sup> And in November 2022, the U.N. General Assembly adopted a resolution calling for the creation of an international register to collect evidence of damage from the war in Ukraine.<sup>116</sup>

In addition to enforcement measures, which are challenging, there are measures that the international community can take to improve compliance with international law protecting NPPs during armed conflict. Like deconfliction mechanisms, which make it clear to belligerents where health care facilities are located, the IAEA could bolster its monitoring and surveillance role to make sure that all parties know precisely where dangerous substances are located and create “no-strike lists.” This would reinforce AP I protections to ensure that NPPs are not attacked. For example, militaries have included dams in

their no-strike lists of protected civilian objects.<sup>117</sup> Ultimately, it is imperative for belligerents to avoid targeting infrastructure containing dangerous forces. The director general of IAEA said that a protection zone “is an absolute and urgent imperative” to prevent a nuclear accident.<sup>118</sup>

Ultimately, this Article makes three key points. First, there are clear protections under existing IHL protecting NPPs during armed conflict. Second, Russia has repeatedly violated these provisions and has done so in multiple ways. Third, holding Russia (a Permanent Member of the U.N. Security Council, possessing a veto) accountable for its violations of international law is difficult.

It is not impossible, though. Hundreds of billions of dollars in Russian assets have been frozen, some from the Russian state and some from Russian oligarchs. There are multiple precedents for seizing state assets and applying them to address violations of international law. It may be more difficult to seize assets from Russian individuals for such purposes, but that may also be possible. The U.N. Compensation Commission provides a precedent and a model for assessing state liability for environmental damage during armed conflict (and one that was predicated on illegal aggressive warfare). There are questions about how best to create a tribunal, but there seem to be several feasible options for Russian civil liability.

Moreover, there are options for pursuing individual criminal liability. The effectiveness of these mechanisms is predicated on getting custody of the responsible individuals. While this seems unlikely, there are a number of promising examples, including the capture and extradition of Abu Agila Masud for the bombing of Pan Am flight 103 over Lockerbie, Scotland, after 34 years<sup>119</sup>; the conviction of former Liberian President Charles Taylor for war crimes; the conviction of former Chadian President Hissène Habré for war crimes and crimes against humanity<sup>120</sup>; and the arrest of former Chilean President Augusto Pinochet and multiple charges for violations committed decades earlier (he died before the proceedings concluded).<sup>121</sup>

These prosecutions represent a small percentage of those responsible for crimes against humanity and war crimes. They send a powerful signal, though, that the international community is increasingly pursuing those responsible for the most serious violations of international

109. Virginia Pietromarchi, *Ukraine Wants a Special Tribunal to Prosecute Putin. Can It Work?*, AL JAZEERA (Dec. 7, 2022), <https://www.aljazeera.com/news/2022/12/7/ukraine-wants-a-special-tribunal-to-prosecute-putin-can-it-work>.

110. *Calls for Special Tribunal for Russia's "War Crimes" in Ukraine*, AL JAZEERA (Jan. 17, 2023), <https://www.aljazeera.com/news/2023/1/17/special-tribunal-needed-for-russian-war-crimes-in-ukraine-eu>; Alexander Ratz, *Germany Calls for Special Tribunal Against Russia Over Ukraine War*, REUTERS (Jan. 16, 2023), <https://www.reuters.com/world/europe/germany-calls-special-tribunal-against-russia-over-ukraine-war-2023-01-16/>.

111. The ICC has pushed back on the proposal of an independent criminal tribunal, asserting that it is more than capable of prosecuting any violations. Molly Quell, *ICC Prosecutor Opposes EU Plan for Special Ukraine Tribunal*, AP (Dec. 5, 2022), <https://apnews.com/article/russia-ukraine-war-crimes-netherlands-the-hague-ursula-von-der-leyen-9e83e1107064ef6e9c375576b998373a>.

112. Jeremy Lewin & Laurence H. Tribe, *\$100 Billion. Russia's Treasure in the U.S. Should Be Turned Against Putin*, N.Y. TIMES (Apr. 15, 2022), <https://www.nytimes.com/2022/04/15/opinion/russia-war-currency-reserves.html>.

113. UKR. CRIM. CODE art. 441 (2001), [https://www.justice.gov/sites/default/files/eoit/legacy/2013/11/08/criminal\\_code\\_0.pdf](https://www.justice.gov/sites/default/files/eoit/legacy/2013/11/08/criminal_code_0.pdf).

114. OLIVIER CORTEN & VAIOS KOUTROULIS, EUROPEAN PARLIAMENT, TRIBUNAL FOR THE CRIME OF AGGRESSION AGAINST UKRAINE—A LEGAL ASSESSMENT (2022), [https://www.europarl.europa.eu/RegData/etudes/IDAN/2022/702574/EXPO\\_IDA\(2022\)702574\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2022/702574/EXPO_IDA(2022)702574_EN.pdf); Laurence H. Tribe, *Does American Law Currently Authorize the President to Seize Sovereign Russian Assets?*, LAWFARE (May 23, 2022), <https://www.lawfareblog.com/does-american-law-currently-authorize-president-seize-sovereign-russian-assets>.

115. Jiayi Zhou & Ian Anthony, *Environmental Accountability, Justice, and Reconstruction in the Russian War on Ukraine*, STOCKHOLM INT'L PEACE RSCH. INST. (Jan. 25, 2023), <https://www.sipri.org/commentary/topical-background/2023/environmental-accountability-justice-and-reconstruction-russian-war-ukraine>.

116. G.A. Res. ES-11/5, *Furtherance of Remedy and Reparation for Aggression Against Ukraine* (Nov. 14, 2022), <https://digitallibrary.un.org/record/3994481>.

117. See, e.g., Michael N. Schmitt, *Attacking Dams—Part I: Customary International Law*, ARTICLES WAR (Jan. 31, 2022), <https://lieber.westpoint.edu/attacking-dams-part-i-customary-international-law/>; Michael N. Schmitt, *Attacking Dams—Part II: The 1977 Additional Protocols*, ARTICLES WAR (Feb. 2, 2022), <https://lieber.westpoint.edu/attacking-dams-part-ii-1977-additional-protocols/>. Even when a dam is on a no-strike list, it does not guarantee protections in practice. See, e.g., Dave Philipps et al., *A Dam in Syria Was on a "No-Strike List." The U.S. Bombed It Anyway*, N.Y. TIMES (Jan. 20, 2022), <https://www.nytimes.com/2022/01/20/us/airstrike-us-isis-dam.html>.

118. IAEA, Update 114, *supra* note 30.

119. Press Release, U.S. Department of Justice Office of Public Affairs, *Pan Am Flight 103 Terrorist Suspect in Custody for 1988 Bombing Over Lockerbie, Scotland* (Dec. 12, 2022), <https://www.justice.gov/opa/pr/pan-am-flight-103-terrorist-suspect-custody-1988-bombing-over-lockerbie-scotland>.

120. *Convicted Ex-Chadian Leader Hissène Habré Dies at 79*, BBC (Aug. 24, 2021), <https://www.bbc.com/news/world-africa-58316923>.

121. *Autumn of the Patriarch*, HUM. RTS. WATCH (Dec. 18, 2006), <https://www.hrw.org/news/2006/12/18/autumn-patriarch>.

law, and that it can pursue them for decades. Moreover, a growing number of those who are responsible will be caught and prosecuted.

On March 17, 2023, the ICC issued arrest warrants for President Vladimir Putin and Maria Lvova-Belova, who serves as Russia's Presidential Commissioner for Children's Rights.<sup>122</sup> The arrest warrant for President Putin charges him with committing the war crime of unlawful deportation and transfer of children from Ukraine, and for the failure to exercise control over civilian and military authorities committing these offenses. The ICC prosecutor has also indicated that his “Office continues to develop multiple, interconnected lines of investigation” and that he “will not hesitate to submit further applications for warrants of arrest when the evidence requires us to do so.”<sup>123</sup> These developments are important for three reasons. First, the ICC has pursued war crimes charges against Russian leaders, even though Russia no longer recognizes the jurisdiction of the ICC. Second, the ICC is issuing warrants not only for President Putin, but for other Russian leaders. Third, even though President Putin and his colleagues are currently safe from extradition, future Russian administrations may decide otherwise—as happened with Serbian President Slobodan Milosevic.<sup>124</sup> With respect to violations of international

law protecting NPPs, this development highlights the ongoing process for holding individuals accountable for actions in the war in Ukraine, and that charges related to the NPPs may yet happen.

It seems likely that more than one accountability mechanism will be used to punish and address the environmental and other damage in Ukraine. A loosely coupled set of accountability mechanisms could collectively prove more effective than their sum. Moreover, it seems likely that the international community will further clarify (and perhaps develop) international law protecting NPPs during armed conflict, as well as expanding the role of international organizations in ensuring the safety of NPPs during conflict.

Russia's weaponization of Ukraine's NPPs is shocking and profoundly disconcerting. Some have even referred to it as “unthinkable.”<sup>125</sup> Not only is it thinkable, it has happened repeatedly in Ukraine, as well as isolated incidents in a handful of earlier conflicts. International law is clear on the topic. While it is challenging to hold Russia accountable, failure to do so could send a dangerous signal to other belligerents. There are options for both civil and criminal liability. In fact, a combination of approaches may prove the most effective in punishing the illegal weaponization of Ukraine's NPPs, repairing and restoring the damage done, and sending a clear warning to other, future belligerents.

122. *Situation in Ukraine: ICC Judges Issue Arrest Warrants Against Vladimir Vladimirovich Putin and Maria Alekseyevna Lvova-Belova* (Mar. 17, 2023), <https://www.icc-cpi.int/news/situation-ukraine-icc-judges-issue-arrest-warrants-against-vladimir-vladimirovich-putin-and>.

123. *Statement by Prosecutor Karim A.A. Khan KC on the Issuance of Arrest Warrants Against President Vladimir Putin and Ms Maria Lvova-Belova* (Mar. 17, 2023), <https://www.icc-cpi.int/news/statement-prosecutor-karim-khan-kc-issuance-arrest-warrants-against-president-vladimir-putin>.

124. Peter Beaumont, *What Does the ICC Arrest Warrant for Vladimir Putin Mean in Reality?*, THE GUARDIAN (Mar. 17, 2023), <https://www.theguardian.com/world/2023/mar/17/icc-arrest-warrant-vladimir-putin-explainer>.

125. CARLSON, *supra* note 43, at 7.