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Prohibition of military attacks on nuclear facilities

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1. Introduction

The war in Ukraine, particularly fighting around the Zaporizhzhya nuclear power plant, has drawn the world's attention to the danger presented by military attacks on nuclear facilities. Such attacks could cause widespread radioactive contamination, affecting civilian populations not only in the state concerned but potentially well beyond that state. This danger highlights the need (a) for clear international legal rules prohibiting military attacks on or near nuclear facilities, and (b) for all states to observe such rules.

Prior to Zaporizhzhya there had been several attacks on nuclear facilities, in most cases before the facilities concerned had commenced operation. Fortunately none of these attacks resulted in significant radiation releases:

- In 1980 Iranian aircraft attacked Iraq's Osirak research reactor, then under construction, damaging ancillary buildings but not the reactor itself.
- In 1981 Israeli aircraft destroyed the Osirak reactor.
- From 1984 to 1987, during the Iran-Iraq war, Iraq launched several air strikes on Iran's two Bushehr power reactors, then under construction, causing major damage.
- In 1991 and 1993, during the First Gulf War, the United States attacked the Tuwaitha research centre and other nuclear targets in Iraq.
- In 2007 Israeli aircraft destroyed Syria's al-Kibar reactor. This was a plutonium production reactor supplied by North Korea and built in secret. At the time of the attack the reactor was close to start-up.
- The most recent example involved a non-state actor – in July 2014 Hamas launched unsuccessful rocket attacks against Israel's Dimona reactor.

2. Legal framework applicable to attacks on nuclear facilities

A. International humanitarian law

Like any other acts of war, military action against nuclear facilities is subject to international humanitarian law. The basic humanitarian principles relating to the legal use of force in armed conflict include:

- Military necessity – use of armed force must be aimed at achieving a legitimate military objective.
- Distinction – the belligerents must distinguish between combatants and civilians, and only target combatants.
- Proportionality – a belligerent may apply only the amount and kind of force necessary to defeat the enemy. The principle of proportionality prohibits attacks, even when directed at a military objective, if they "may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof,

> which would be excessive in relation to the concrete and direct military advantage anticipated".[1]

Other principles of international humanitarian law potentially relevant to attacks on nuclear facilities include:

- The prohibition of means of warfare which are intended or may be expected to cause widespread, long-term and severe damage to the natural environment.[2]
- The principle of neutrality – belligerent forces must not cause transborder damage to a neutral state due to use of a weapon in a belligerent state.

B. Treaties specifically addressing attacks on nuclear facilities

Additional Protocols I and II to the 1949 Geneva Conventions contain specific provisions dealing with attacks on nuclear power plants. Apart from these Protocols, currently the only multilateral treaty dealing with attacks on nuclear facilities is a regional treaty, the 1996 African Nuclear-Weapon-Free Zone Treaty, commonly known as the Pelindaba Treaty. In addition, attacks on nuclear facilities are prohibited by a bilateral treaty concluded between India and Pakistan in 1988.

Additional Protocols to the Geneva Conventions

Article 56 of Additional Protocol I prohibits attacks against nuclear power plants:

> Works and 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. (underlining added)[3]

Regrettably this prohibition is qualified, it does not apply 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". However, Article 56 also stipulates that "In all cases, the civilian population and individual civilians shall remain entitled to all the protection accorded them by international law …"

It is not clear how the inconsistency between these provisions – an attack may be permitted if it is the only way to terminate support for military operations, even though it might cause severe civilian losses, but civilians are entitled to all the protection accorded them by international law – would be reconciled.

This prohibition is repeated, without the problematic qualification, in Article 15 of Additional Protocol II.[4]

These two Articles are not ideal – they apply only to nuclear power plants, not to other nuclear facilities, and the qualification in Article 56 is potentially troublesome – but the acceptance of the two Protocols is near universal. Protocol I has 174 parties and three signatories: the US, Iran and Pakistan. Although these three states have not ratified the Protocol, as signatories they are obliged under the general law of treaties to refrain from acts that would defeat the

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1. Additional Protocol I to the Geneva Conventions, Article 51.
2. Additional Protocol I, Article 55.
3. https://ihl-databases.icrc.org/applic/ihl/ihl.nsf/Article.xsp?action=openDocument&documentId=3376730ECD9DF7B1C12563CD0051DD37.
4. https://ihl-databases.icrc.org/applic/ihl/ihl.nsf/Article.xsp?action=openDocument&documentId=27C1F262F0875DDFC12563CD0051E8C8.

object and purpose of the Protocol. Protocol II has 196 parties, including the US, Iran and Pakistan. Russia is a party to both Protocols. Russia partially withdrew from Protocol I in 2019, but remains bound by all substantive provisions.[5]

Nuclear power plants are not the only facilities where potentially substantial radiation releases are possible. Large research reactors, reprocessing plants, spent fuel storage facilities and high-level waste storage facilities also warrant protection against attack. When these provisions of the Protocols were negotiated, initially the reference to nuclear power plants was intended to be illustrative, not a limitation, but consensus could not be reached to extend the Protocols to other facilities.[6] This is an aspect that needs to be re-visited.

Pelindaba Treaty

The 1996 Pelindaba Treaty[7] prohibits attacks on all nuclear facilities, without qualification. Article 11 provides:

> Each Party undertakes not to take ... any action aimed at an armed attack by conventional or other means against nuclear installations in the African nuclear-weapon-free zone.

Currently no other nuclear-weapon-free zone treaty has such a provision. It is to be hoped that when a Middle East nuclear-weapon-free zone treaty is negotiated it will contain a similar provision.[8]

India-Pakistan agreement

The only other treaty in this field is bilateral, but important nonetheless – the 1988 Agreement on the Prohibition of Attack against Nuclear Installations and Facilities concluded between India and Pakistan.[9] This has an unqualified prohibition, applying to all nuclear facilities:

> Each party shall refrain from undertaking, encouraging or participating in, directly or indirectly, any action aimed at causing the destruction of, or damage to, any nuclear installation or facility in the other country.

Under this agreement the parties regularly exchange updated lists of their nuclear facilities.

3. Other multilateral action

Conference on Disarmament

In the 1980s the Conference on Disarmament (CD) developed a compilation of draft provisions for a multilateral treaty prohibiting attacks on nuclear facilities. The discussion in the CD aired some of the key issues in this area, for example, the legitimate concern that particular nuclear facilities might be used to produce nuclear weapons. One suggestion was that the prohibition

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5. Russia withdrew from mandatory acceptance of the International Fact-Finding Commission provided for under Protocol I, but remains party to all other provisions of the Protocol. See https://civilmplus.org/en/news/what-does-russia-s-withdrawal-from-the-jurisdiction-of-the-international-fact-finding-commission-mean-comment-by-sergei-krivenko/.
6. See *Protection of Civilian Nuclear Installations in Time of Armed Conflict*, V. Lamm, Nuclear Law Bulletin No. 72 (2003), https://www.oecd-nea.org/law/nlb/nlb-72/029_038.pdf.
7. https://www.iaea.org/publications/documents/treaties/african-nuclear-weapon-free-zone-treaty-pelindaba-treaty.
8. It may help that some parties to the Pelindaba Treaty are also prospective parties to the future Middle East nuclear-weapon-free zone.
9. https://nuke.fas.org/guide/india/doctrine/nucl.htm.

on attacks would apply specifically to facilities subject to IAEA safeguards inspections. This work was never taken further.

International Atomic Energy Agency

The issues discussed in the CD were reflected in IAEA General Conference resolutions, for example in 1990[10]:

> The General Conference, … aware of the fact that an armed attack on a nuclear installation could result in radioactive releases with grave consequences within and beyond the boundaries of the State which has been attacked, (and) convinced of the need to prohibit armed attacks on nuclear installations from which such releases could occur and of the urgency of concluding an international agreement in this regard, …
>
> 1. Recognizes that attacks or threats of attack on nuclear facilities devoted to peaceful purposes could jeopardize the development of nuclear energy;
> 2. Considers that the safeguards system of the Agency is a reliable means of verifying the peaceful uses of nuclear energy.

In 2009 the IAEA General Conference, in a decision on "Prohibition of armed attack or threat of attack against nuclear installations, during operation or under construction", noted that:

> any armed attack on and threat against nuclear facilities devoted to peaceful purposes (underlining added) constitutes a violation of the principles of the United Nations Charter, international law and the Statute of the Agency.[11]

Current action by the IAEA regarding attacks on nuclear facilities in Ukraine is discussed below.

Nuclear Non-Proliferation Treaty Review Conferences

Action 64 from the 2010 NPT Review Conference called on all states to abide by the 2009 IAEA General Conference decision.

There has been no subsequent decision from NPT Review Conferences on this subject. The recently concluded 2020 NPT Review Conference (delayed until August 2022) failed to reach consensus on a Final Document, due to disagreement over specific language relating to Zaporizhzhya. On the general issue of attacks on nuclear facilities the Draft Final Document contained the following paragraph:

> 100. The Conference expresses grave concern at attacks or threats of attack on nuclear facilities devoted to peaceful purposes, which jeopardize nuclear safety and nuclear security. The Conference also considers that attacks or threats of attack on nuclear facilities devoted to peaceful purposes have dangerous political, economic, human health, and environmental, implications and raise serious concerns regarding the application of international law, which could warrant appropriate action in accordance with the provisions of the Charter of the United Nations.

In addition, the Draft Final Document referred to the IAEA's "Seven Pillars", discussed below:

> 98. The Conference reminds all States Parties of the importance of nuclear safety and security regarding peaceful nuclear facilities and materials in all circumstances, including in armed conflict zones, and of the IAEA Director General's "Seven Indispensable Pillars on Nuclear Safety and Security" derived from IAEA safety standards and nuclear security guidance.

10. GC(XXXIV)/RES/533 of October 1990.
11. GC(53)/DEC/13 of September 2009.

4. Zaporizhzhya situation

The Zaporizhzhya nuclear power plant is Europe's largest, comprising six pressurised water reactors (Russian VVER type) with a total capacity of 5,700 MWe (megawatts electrical). Before the war Zaporizhzhya supplied 20% of Ukraine's electricity.

Russian forces took control of the Zaporizhzhya site on 4 March. A number of buildings were damaged by shelling, but the physical integrity of the reactors and their safety and security systems were not affected at that time. Ukrainian staff have continued to operate the site, but under considerable stress due to the presence of occupying forces and ongoing military action. Russian forces have moved military equipment and supplies onto the site, and shelling has continued around the site.

The intensity of shelling increased in August and into this month (September). Damage has included the spent fuel storage area and the plant's external power supply system. This raises serious safety concerns, particularly, as discussed below, regarding damage to the external power supply.

The IAEA was able to gain access to the Zaporizhzhya site on 1 September, and IAEA Director General Grossi led an IAEA team to assess the situation. On 6 September the IAEA issued a detailed report on this visit[12] and DG Grossi briefed the UN Security Council.[13]

The IAEA report says:

> The situation is unprecedented. It is the first time a military conflict has occurred amid the facilities of a large, established nuclear power programme. A nuclear accident can have serious impacts within the country and beyond its borders ...

At the Security Council, DG Grossi called for the end of shelling near the plant, and for the establishment of a Nuclear Safety and Security Protection Zone around the plant. UN Secretary-General Guterres has called for a demilitarised zone as well as Russia's withdrawal from the plant.[14]

Two IAEA staff remain at Zaporizhzhya to monitor the situation. The IAEA has called for off-site power supply redundancy to be reinstated, and for both sides to commit to supporting logistical and supply chains for continued nuclear safety and security of the plant.

On 9 September DG Grossi issued a statement[15] on a serious developing situation at Zaporizhzhya. Due to continuing shelling, Zaporizhzhya had lost all offsite power. The operator was considering shutting down the only remaining operating reactor. The entire power plant would then be totally reliant on emergency diesel generators for ensuring vital nuclear safety and security functions. At the time of writing this paper (11 September) it was reported that an external power line had been restored and the last reactor had been shut down.

Safety aspects

The Zaporizhzhya reactors are within containment structures that should be sufficient to protect the reactors from damage by shelling. These containments are designed to prevent escape of radiation in event of an accident. In either case however the effectiveness of the containments would depend on the intensity of any attack.

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12. Nuclear Safety, Security and Safeguards in Ukraine, 2nd Summary Report, https://www.iaea.org/sites/default/files/22/09/ukraine-2ndsummaryreport_sept2022.pdf.
13. https://www.iaea.org/newscenter/news/un-security-council-iaea-grossi-calls-for-establishment-of-nuclear-safety-and-security-protection-zone-at-zaporizhzhya-npp.
14. https://news.un.org/en/story/2022/09/1126131.
15. https://www.iaea.org/newscenter/statements/director-generals-statement-on-serious-situation-at-ukraines-zaporizhzhya-nuclear-power-plant.

If fighting is taking place around a nuclear power plant the reactors should be shut down. This is a difficult decision because it will deprive the population of power from the plant, but it is safest to cool down the reactors as quickly as possible in case of damage to the plant's safety systems.

The most likely accident situation is loss of water cooling, due to loss of electrical power for water circulation or damage to cooling circuits. Cooling is vital for the reactors and the spent fuel ponds. Even where all reactors are shut down, the residual heat in the fuel will remain high enough to damage the fuel if it is not adequately cooled. Cooling the fuel will require reliable electricity and water supply over a period of many months, perhaps a year or more.

In normal operation the reactors themselves generate the electricity they require, but if the reactors are shut down power must be available from external sources or the plant's emergency diesel generators. Emergency generators are a last resort, as without external power there is no fallback if there is any problem with the generators or their diesel fuel supplies.

For these reasons a nuclear safety and security protection zone as proposed by the IAEA is essential, but by itself is not sufficient – it is also essential to ensure the secure supply of electricity.

In briefing the IAEA Board of Governors on 2 March, DG Grossi outlined "seven indispensable pillars" for ensuring nuclear safety and security 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.

Nuclear safety must be paramount – all parties must work to ensure these basic standards are met.

5. Conclusions

It is essential to cease fighting at and in the vicinity of the Zaporizhzhya plant immediately, and to ensure secure electrical supply to the plant to maintain its safety.

It is also essential for Russian forces to withdraw from the plant, and for a nuclear safety and security protection zone to be established around the plant, as proposed by the IAEA. In practical terms this could encompass the demilitarised zone proposed by Secretary-General Guterres. As to the meaning of "demilitarised", Additional Protocol I to the Geneva Conventions allows for defensive activities, in Article 56:

> 5. The Parties to the conflict shall endeavour to avoid locating any military objectives in the vicinity of the works or installations mentioned in paragraph 1. Nevertheless, installations erected for the sole purpose of defending the protected works or installations from attack are permissible and shall not themselves be made the object of attack, provided that they are not used in hostilities except for defensive actions necessary to respond to attacks against the protected works or installations and that their armament is limited to weapons capable only of repelling hostile action against the protected works or installations.

Thus Ukraine has the right to have protective forces at its nuclear power plants. If Russia is concerned its withdrawal from Zaporizhzhya will provide some military advantage to Ukraine,

consideration could be given to locating UN military observers at the plant to monitor that Ukraine acts consistently with Article 56.

The lesson from Zaporizhzhya is that the unthinkable – an attack on an operating nuclear power plant – can happen. The international community must consider how to strengthen rules and practices against this happening again. Such an attack is expressly prohibited by Additional Protocols I and II of the Geneva Conventions, but these Protocols could be improved:

- Protocol I has a confusing qualification about military necessity – this is potentially inconsistent with the protection given civilians by international law.
- A belligerent might claim an attack is permissible if it does not actually cause severe civilian losses. This is a distortion of the Protocols, which are expressed in terms of *possibility* – that an attack *may* cause the release of dangerous forces. No matter how good a plant's protective systems may be, it is irresponsible to put these to the test through dangerous actions. If such actions result in the meltdown of reactor cores, then even if the reactor containments succeed in preventing radiation release, the destruction of a major source of electricity for the civilian population would violate the principle of proportionality.
- Finally, the specific prohibition in the Protocols applies only to nuclear power plants. Consideration should be given to extending the prohibition to other facility types where populations or the environment could be endangered by radiation release.

The Protocols could be supplemented through specific treaty action by states, regionally as with the Pelindaba Treaty and bilaterally as with India and Pakistan.

The international community should support the application of the IAEA's "Seven Pillars". States should also ensure that appropriate rules will apply in the event of hostilities, or the possibility of hostilities, in the vicinity of nuclear facilities. These should include observance of demilitarised zones around nuclear facilities and assurance of electrical and other supplies essential to maintain safety.