

The US Army War College Quarterly: Parameters

Volume 52
Number 4 *Volume 52, Number 4 Winter Issue*

Article 8

11-18-2022

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Recommended Citation

Henry D. Sokolski, "Present Danger: Nuclear Power Plants in War," *Parameters* 52, no. 4 (2022), doi:10.55540/0031-1723.3183.

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Present Danger: Nuclear Plants in War

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ABSTRACT: After Russia’s unprecedented seizure of Ukraine’s nuclear plant at Zaporizhzhya, the United States needs to adjust its military planning and policies to cope with hostile military forces’ targeting, seizure, and garrisoning of armed forces at large operating nuclear plants and clarify its policies regarding possible US targeting of such plants. This article is the first to analyze these concerns. It compares Russia’s assaults with previous strikes against research reactors and nonoperating nuclear plants in the Middle East and clarifies what new military measures and policies will be needed to cope with military operations against large, operating nuclear plants. US Army and Pentagon officials, as well as military and civilian staff, will discover ways to mitigate and reduce future military harm to civilians in war zones and understand the operational implications of military assaults on and seizures of civilian nuclear facilities.

Keywords: Zaporizhzhya, nuclear reactors, *Law of War Manual*, *Civilian Harm Mitigation and Response Action Plan*, radiation

Zaporizhzhya’s nuclear plant, as of this writing, has been placed on cold shutdown. The plant and its military vulnerabilities, however, have generated some of the world’s most sensational headlines.¹ Earlier this summer, online reports featured photographs of the plant’s damaged transformer, a system critical to ensuring a steady supply of electricity to the plant’s all-important reactor coolant and safety systems. Throughout August and September, news organizations detailed how the plant’s external main power lines—built to keep electricity flowing to its reactors—had been cut. Some days, some of the plant’s six reactors were operating. Other days, none were. Repeatedly, the viability of the plant’s emergency diesel fuel electrical generators was “Topic A.”

Each of these stories raised the specter of a military-induced Fukushima: strikes against the plant or the power lines feeding into it that could cut off the electricity needed to run the reactors’ coolant pumps and safety equipment followed by nuclear fuel failures and a massive radiological release over Ukraine and its neighbors. Add to this firsthand accounts of Russian torture, the murder of “disloyal” Ukrainian

1. Wikipedia, s.v. “Crisis at the Zaporizhzhia Nuclear Power Plant,” last modified September 14, 2022, https://en.m.wikipedia.org/wiki/Crisis_at_the_Zaporizhzhia_Nuclear_Power_Plant.

reactor staff, and an emergency International Atomic Energy Agency visit, and you have everything needed for a Netflix docudrama.

What you would not have, however, and what is still lacking, is a Pentagon assessment of what all this means militarily.

Close friends have offered hints. Japanese Prime Minister Fumio Kishida called for stationing security forces at each of Japan's nuclear plants, and his administration also suggested the possibility of deploying dedicated missile defense systems (as Belarus has done at its nuclear plant since 2019).² Seoul crafted military exercises this year with US forces that included explosives detonating at one or more of South Korea's civilian reactor sites.³ Ukrainian President Volodymyr Zelensky accused Russia of turning Zaporizhzhya into a prepositioned, slow-burning, radiation-dispersing "nuclear weapon."⁴ Meanwhile, Tobias M. Ellwood, the British House of Commons Select Committee on Defense chairman, insisted that if Russia intentionally struck Zaporizhzhya and spread harmful radioactivity to Poland or Romania, it would trigger NATO's Article 5.⁵ Moldova, Romania, and Ukraine did more than talk. All three countries prepared to distribute iodine pills to their citizens (to reduce the thyroid cancers radiation might induce if Zaporizhzhya leaked radiation).⁶

The following map shows what might happen as a result of a nuclear accident at the Zaporizhzhya nuclear power plant. It shows the spread of simulated contamination levels after a hypothetical core meltdown at Zaporizhzhya 1.

2. Eric Johnston, "Japan to Discuss Creating New Police Unit to Guard Nuclear Plants," *Japan Times* (website), March 14, 2022, <https://www.japantimes.co.jp/news/2022/03/14/national/nuclear-plant-police-unit/>; and "TOR-M2 Air Defense Missile Systems to Protect Belarus Nuclear Power Plant," Army Recognition (website), December 8, 2018, https://www.armyrecognition.com/december_2018_global_defense_security_army_news_industry/tor-m2_air_defense_missile_systems_to_protect_belarus_nuclear_power_plant.html.

3. Sang-ho Song, "Upcoming S. Korea-U.S. Training Involves Drills on Repelling Attacks, Staging Counterattacks," *Yonhap News Agency* (website), August 1, 2022, <https://en.yna.co.kr/view/AEN20220801004000325>.

4. Rebecca Falconer, "Zelensky Says Russian Forces Using Zaporizhzhia Plant as 'Nuclear Weapon,'" *Axios* (website), September 4, 2022, <https://www.axios.com/2022/09/05/zelensky-russia-zaporizhzhia-plant-nuclear-weapon>.

5. Article 5 requires NATO members come to the defense of any other member that suffers a military attack. See Tobias M. Ellwood (@Tobias_Ellwood), "Let's make it clear: ANY deliberate damage causing potential radiation leak to a Ukrainian nuclear reactor would be a breach of NATO's Article 5. @thetimes," Twitter, August 19, 2022, 1:55 a.m., https://twitter.com/Tobias_Ellwood/status/1560505699179925509?s=20&t=FYfhPvuxW0pHm8lwXfe99w.

6. Josh Lederman, "Radiation Tablets Are Handed out near Ukrainian Nuclear Plants as Fears of a Leak Mount," *NBC News* (website), August 26, 2022, <https://www.nbcnews.com/news/world/russia-ukraine-war-zaporizhzhia-nuclear-plant-radiation-fears-iodine-rcna45041>; Ben Turner, "Ukraine War: Moldova Ships in One Million Iodine Pills amid Fears of Nuclear Disaster," *Euronews* (website), August 16, 2022, <https://www.euronews.com/2022/08/15/moldova-ships-in-radiation-pills-as-fighting-rages-near-zaporizhzhia-nuclear-power-plant-i>; and Helen Collis, "Romania to Issue Iodine Tablets as Russian War Continues in Neighboring Ukraine," *Politico* (website), April 3, 2022, <https://www.politico.eu/article/romania-to-issue-iodine-tablets-as-russian-aggression-continues-in-bordering-ukraine/>.



Figure 1. Simulation of contamination spread after a hypothetical core meltdown at Zaporizhzhya 1, using weather information from the third week of March 2021, and simulated contamination levels after a hypothetical core meltdown at Zaporizhzhya 1, using weather information from the fourth week of March 2021

(Map by Pete McPhail)

What has the Pentagon made of this? So far, not much. The Department of Defense’s spokesperson merely observed the danger and “irresponsibility” of Russian military assaults on the Zaporizhzhya plant.⁷ But that is it. One might have expected him to reference assessments the Department might have made following any of the more than 13 military assaults Iran, Iraq, Israel, the United Kingdom, or the United States mounted against reactors in Iran, Iraq, Israel, and Syria. Perhaps no such assessments were undertaken by the Department. If there were, it would help clarify how the Zaporizhzhya attacks differ from those made in the Middle East and what those differences portend.

The short answer to the latter question is plenty.

First, none of the Middle Eastern attacks were directed against operating powered reactors.⁸ Not so with Zaporizhzhya. Before the war, the plant produced more nuclear power than any other European plant. With Russia’s assault on Zaporizhzhya, the drama of a possible massive radiological release is real; with the previous strikes in the Middle East, it was not.

Second, unlike the attacks on Zaporizhzhya, none of the raids against Middle Eastern reactors were mounted with long-range precision drones or missiles. All of them were executed either with attack bombers or inaccurate Scuds. The Middle Eastern strikes, moreover, were aimed to destroy the entire nuclear plant, not particular subsystems. Again, not so with Zaporizhzhya. At different times and separately, the Zaporizhzhya plant’s on-site transformer was hit, its four inbound power transmission lines felled, and its spent fuel storage area struck. Each of these separate strikes ratcheted up fears similar to what one might experience climbing a nuclear escalatory ladder (think: Herman Kahn, version 2.0). In contrast, past Middle Eastern reactor attacks were binary—either total hits or relatively harmless misses.

Third, none of the attacked plants in the Middle East were ever seized and operated by the attacking party. Not so with Zaporizhzhya. The Russians not only seized Zaporizhzhya and assumed its operation, but they also used it as a missile and artillery launch site and allowed (or inflicted) damage to the structure to manipulate how much electricity Ukrainians might get. Russia also threatened to redirect the plant’s electrical production toward Russia and

7. Paul D. Shinkman, “Pentagon Blasts Russian Provocations at Ukrainian Nuclear Plant as ‘Height of Irresponsibility,’” *U.S. News and World Report* (website), August 19, 2022, <https://www.usnews.com/news/national-news/articles/2022-08-19/pentagon-blasts-russian-provocations-at-ukrainian-nuclear-plant-as-height-of-irresponsibility>.

8. Saddam did fire two errant Scuds at Israel’s military small production reactor at Dimona, and the United States bombed Iraq’s research reactor at Osirak in 1991. Neither unit was a power plant. See Jonathan Ferziger, “Iraq Lobs Two Scuds at Israel,” *United Press International* (website), February 25, 1991, <https://www.upi.com/Archives/1991/02/25/Iraq-lobbs-two-Scuds-at-Israel/6123667458000/>.

Russian-held territory to the east and south. Come winter, Russia may literally be able to freeze out local Ukrainian opposition.

Fourth, none of the Middle Eastern plants were near major urban areas. Before the war, Zaporizhzhya and the surrounding area had nearly 1.7 million residents.⁹ Many hundreds of thousands still live there. Given the risk of radiological release, Zelensky asked them to evacuate.¹⁰ The movement of so many residents at once, however, could easily complicate local military operations for the Ukrainians and the Russians. More importantly, the radioactivity the plant might release could go in several directions. If the winds were to blow west (which they most often do), then Russia would suffer; east, Ukraine and Romania (a NATO member); north, Poland and possibly other NATO member states; and south, Türkiye (another NATO member). A North Korean summertime attack on South Korean reactors would release more radioactivity over Japan than South Korea. In the winter, the reverse would occur. None of these considerations were factors in previous Middle East raids.

Finally, and related, none of the targeted Middle Eastern reactors were located in or adjacent to states the United States was treaty-bound to defend. Washington has no treaty security guarantees for any state in the Middle East—not even Israel. It does, however, have them for NATO in Europe, Japan, and South Korea. Most NATO members operate large reactors. So do Japan and South Korea. Taiwan also operates nuclear power plants. Chinese, Russian, and North Korean authorities (as well as former officials) have suggested they might strike these facilities. Seoul, Tokyo, Moldova, Romania, and Taipei are all now considering defensive measures.

What, then, if anything, should the Pentagon do? Three things come to mind.

Assess the military, deterrence, and security alliance implications of waging war where nuclear plants operate, including in Europe, the Middle East, and Asia. All of these theaters host American military bases. If reactors in the region are hit, how vulnerable might US troops be to possible radiation releases? What active or passive defense measures would be useful for them to take? What should US troops do if a state whose security the United States guarantees calls for assistance after one of its reactors has been hit or if its citizens are irradiated after a strike is made against a neighbor's nuclear plant? What assistance, if any, should the Pentagon be prepared to offer to replace emergency electricity that might be lost after such attacks? In either war or

9. "Population of Zaporizhzhia Oblast," Google Search, <https://www.google.com/search?q=population%20of%20zaporizhzhia%20oblast>.

10. Max Hinde, Conor Humphries, and Alex Richardson, "Ukraine Calls for Evacuation of Zaporizhzhia Nuclear Plant Town," Reuters (website), September 7, 2022, <https://www.reuters.com/world/europe/ukraine-calls-evacuation-zaporizhzhia-nuclear-plant-town-2022-09-07/>.

peacetime, should the Pentagon offer air and missile defenses, intelligence, or first responder assistance to help protect friendly nations' nuclear plants? What forms might this assistance take? What counteroffensive actions might be considered proportionate to strikes made against allied nuclear plants?

The Pentagon's replies may differ for different countries. Its general conclusions, however, should be dialed into any future *Nuclear Posture Review* and be a part of the Pentagon's defense guidance. Bureaucratically, accomplishing this may be difficult. Currently, there is no office responsible for conducting such analysis. The regional commands may feel uncomfortable assuming this task unless told to do so. The Pentagon's Office of Nuclear Deterrence Policy in Open Supervised Defense Protocol, the Office of the Assistant Secretary of Acquisition (Nuclear, Chemical, and Biological), and the Office of the Assistant Secretary of Defense for Strategy are all plausible places to tangle with these matters; yet, so far, none has taken charge. Another possible contributor would be the secretary of the Army, whom the secretary of defense just made the lead proponent for a newly minted *Civilian Harm Mitigation and Response Action Plan*.¹¹ Congress could instruct any of these organizations or individuals to take the lead in producing the needed nuclear plant analysis. Congress should make this assignment quickly and ensure the analysis is updated routinely.

Separately, the Pentagon should take a more active role in reviewing US nuclear export license applications with an eye to how vulnerable such plants might be to military assaults. The Pentagon already serves as the lead in identifying the location of potential future war zones. The Pentagon also manages a military reactor program and says it wants to deploy these reactors overseas.¹² As such, it is already on the hook to clarify how safe these plants might be and where they would be safest to deploy.¹³ Armed with this information, the Pentagon should be tapped for any assessment of the vulnerabilities of reactors private US firms may want to export (and, coincidentally, that American military forces may be asked to defend). This requirement is hardly a new ask. It is already required by the Nuclear Nonproliferation Act of 1978, which

11. US Department of Defense, *Civilian Harm Mitigation and Response Action Plan (CHMR-AP)*, August 25, 2022, <https://media.defense.gov/2022/Aug/25/2003064740/-1/-1/1/CIVILIAN-HARM-MITIGATION-AND-RESPONSE-ACTION-PLAN.PDF>.

12. Patrick Tucker, "Defense Department Sets Out to Build Miniature Nuclear Reactor, Again," *Defense One* (website), April 15, 2022, <https://www.defenseone.com/technology/2022/04/defense-department-sets-out-build-miniature-nuclear-reactor-again/365766/>.

13. Henry D. Sokolski and Bryan Clark, "Military Micro-Reactors: Waging Yesterday's Wars while Losing the Future's," *Defense News*, Nonproliferation Policy Education Center (website), June 15, 2021, <https://npolicy.org/military-micro-reactors-waging-yesterdays-wars-while-losing-the-futures-defense-news/>.

expects the Department of Defense to comment on the national security implications of US civilian nuclear exports.¹⁴

The Defense Department should also clarify and strengthen current guidance on targeting nuclear plants in war. All the world's nations except India, Iran, Israel, Pakistan, Türkiye, and the United States have ratified the 1977 Protocol I to the Geneva Convention. Chapter III of the protocol strongly discourages targeting nuclear electrical generating plants.¹⁵ Russia withdrew from the protocol in 2019. Washington signed it in 1977, indicating an intention to ratify it—which it never did. In the 1980s, the Reagan administration opposed ratification because of concerns about what constituted liberation movements under the protocol.¹⁶ Some may also now believe the United States should do nothing to restrict its freedom of action to strike nuclear electricity-generating plants. Even the protocol allows for targeting such plants in extremely rare cases. Military justifications for such strikes are few and far between: military forces will hardly want to operate in, or liberate, regions near a plant if it has irradiated the region after being hit.

Washington wants to condemn Moscow for its strikes against the plant at Zaporizhzhya. What makes this awkward is the Pentagon's 2016 *Law of War Manual*, which ultimately allows US military commanders to target nuclear power plants if they think doing so is "important."¹⁷ Given the outsized political, diplomatic, and military downsides of producing a major radiological release, it would be helpful if the Pentagon could make the presumption against attacking nuclear plants at least as clear as the protocol makes it. One might want to clarify further that nuclear electricity-generating stations should include related nuclear facilities, such as reprocessing plants, spent fuel storage sites, etc.

Another issue worth resolving is what US policy should be regarding attacks against large research reactors (something the *Law of War Manual* does not mention). This clarification could be accomplished by asking the Pentagon to wire brush its *Law of War Manual*. It would also make sense for Congress to elevate any military decision to target such plants to the commander in chief. Currently, this action is required for the release of nuclear

14. "Nuclear Non-Proliferation Act of 1978," 22 USC § 3201 (1978), <https://www.govinfo.gov/content/pkg/STATUTE-92/pdf/STATUTE-92-Pg120.pdf>. The Department of Defense may also comment on intangible nuclear technology transfers (known as Part 810 transfers), including those to China.

15. "Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of Intentional Armed Conflicts (Protocol I), June 8, 1977," International Committee of the Red Cross (website), n.d., <https://ihl-databases.icrc.org/ihl/INTRO/470>.

16. Theodor Meron, "The Time Has Come for the United States to Ratify Geneva Protocol I," *American Journal of International Law* 88, no. 4 (October 1994), 678–86, <https://www.jstor.org/stable/2204135>.

17. Department of Defense, *Department of Defense Law of War Manual*, June 2015, updated December 2016, <https://dod.defense.gov/Portals/1/Documents/pubs/DoD%20Law%20of%20War%20Manual%20-%20June%202015%20Updated%20Dec%202016.pdf?ver=2016-12-13-172036-190>.

weapons for use. It would also make sense for any targeting of nuclear plants in war zones. After what has unfolded at Zaporizhzhya, civilian nuclear plants must be viewed as prepositioned nuclear weapons that, if hit, could potentially disperse strategically disruptive amounts of radiation over thousands of square miles—making the decision to attack them more than a theater or tactical matter.

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