

Nuclear Energy, Climate Change and Water: A Crisis

As the climate crisis brings droughts, floods, wildfires, food shortages, extreme weather and other threats to human life,¹ advocates and policy makers seek solutions to prevent environmental catastrophe, including false solutions like nuclear power. Not only are the operations of nuclear power plants highly vulnerable to a changing climate, but nuclear power threatens water supplies.² The relationship between nuclear power plants and water complicates the heralding of the sector as a solution to climate change.

Nuclear Power's Water Dependence Is Threatened by Climate Change

Nuclear power plants withdraw and consume significant amounts of water to produce electricity with steam engines and to cool process water. For every megawatt-hour of electricity produced, nuclear plants on average consume roughly 750 gallons of water, whereas solar and wind generation use on average 125 gallons and less than 1 gallon, respectively.³ Nuclear is consistently among the energy sources that require the most water, in some cases using more water than fossil fuels.⁴

Heavy reliance on water makes nuclear power plants vulnerable to a changing climate where extreme weather events are more prevalent. Droughts, water shortages and increasing water temperatures can reduce electricity generation at facilities or cause temporary shutdowns.⁵ For example, Brown's Ferry Nuclear Plant in Alabama shut down temporarily in response to a drought in 2007.⁶ High water and air temperatures force plants to reduce electricity output, especially in the summer when electricity demand is highest, making them an unreliable energy source in a warming climate.⁷

Nuclear Power Plants Are in Hot Water

Water is used in nuclear plants to condense the steam needed for electricity generation; it is warmed during the process, then typically discharged back into rivers, lakes



PHOTO CC-BY-SA © D. RAMEY LOGAN / COMMONS.WIKIMEDIA.ORG

and oceans, releasing heat into the aquatic environment.⁸ This heat, referred to as thermal pollution, can harm ecosystems.⁹ Thermal pollution from power plants can lead to declining fish populations and promote algal blooms that produce harmful toxins.¹⁰ To minimize damage to the environment, temperature limits are set for the water bodies that receive nuclear power plant discharges.¹¹ But climate change and warmer waters have pushed nuclear power plants to reduce their electricity output with greater frequency to comply with temperature limits.¹²

Limits on how warm the water can be before being used as cooling water within the nuclear power plant also restrict operations at the reactors. For example, one unit at Millstone Power Station, which provides Connecticut with half of its electricity, was forced to shut down for almost two weeks in 2012 when temperatures in Long Island Sound were too high.¹³

Nuclear Energy Puts Clean Water at Risk

Water contamination is a reality plaguing nuclear energy. The current fleet of nuclear power plants is aging and threatened by crumbling infrastructure. Roughly half of the nuclear reactors in the United States have been operating since before the 1980s and longer than the 40 years the Nuclear Regulatory Commission (NRC) originally licensed reactors to operate.¹⁴

Analyses by the NRC's own researchers concluded that nuclear power plants are susceptible to cracks and corrosion.¹⁵ An *Associated Press* investigation found that 74 percent of nuclear power plants had leaked radioactive tritium into ground water from aging pipes.¹⁶ While most leaks remained within the facility boundaries, some migrated offsite and contaminated private drinking wells.¹⁷ Officials have said that the levels of tritium posed no health threat, but the presence of tritium can often indicate that other more powerful radioactive isotopes may have leaked as well.¹⁸

Uranium mining also threatens water supplies when they become contaminated with uranium during extraction and flooding.¹⁹ Uranium-contaminated wastewater has polluted environments around mines, including aquifers and springs near the Grand Canyon.²⁰ Spills of uranium tailings (toxic and radioactive waste produced as uranium ore is processed and enriched) and uranium hexafluoride

(the form of uranium used during enrichment) around the mines have released harmful pollutants comparable to those at the Three Mile Island incident, the 1979 nuclear meltdown in Pennsylvania.²¹ A massive spill in 1979, for example, released more than 90 million gallons of radioactive wastewater and 1,100 tons of uranium waste in New Mexico, devastating Navajo lands and contaminating drinking water. Decades later, nearby residents still face widespread contamination due to inadequate cleanup and remediation.²²

Conclusion

The climate vulnerabilities of nuclear power plants and the risks that the plants pose to our water make nuclear energy a poor solution to the climate crisis. To stave off the catastrophic impacts of climate change, we must — and can — shift to 100 percent clean, renewable electricity by 2030.

Endnotes

- 1 Field, Christopher B. et al. Intergovernmental Panel on Climate Change (IPCC). "Climate Change 2014. Impacts, Adaptation, and Vulnerability: Summary for Policymakers." 2014 at 4 and 6.
- 2 Donn, Jeff. "Part II: AP Impact: Tritium leaks found at many nuke sites." *Associated Press*. June 21, 2011; Neuhauser, Alan. "Nuclear power, once seen as impervious to climate change, threatened by heat waves." *U.S. News*. July 1, 2019.
- 3 Meldrum, J. et al. "Life cycle water use for electricity generation: A review and harmonization of literature estimates." *Environmental Research Letters*. Vol. 8, No. 1. March 12, 2013 at 13.
- 4 Macknick, Jordan et al. "Operational water consumption and withdrawal factors for electricity generating technologies: A review of existing literature." *Environmental Research Letters*. Vol. 7, No. 4. December 20, 2012 at 6.
- 5 *Ibid.* at 2; Neuhauser (2019).
- 6 Macknick et al. (2012) at 2.
- 7 Neuhauser (2019).
- 8 Vine, Gary. Longenecker & Associates. Prepared for U.S. Department of Energy. "Cooling Water Issues and Opportunities at U.S. Nuclear Power Plants: A Report to the U.S. Department of Energy. Office of Nuclear Energy. Revision 1." INL/EXT-10-20208. December 2010 at 2-3 to 2-4; Verones, Francesca et al. "Characterization factors for thermal pollution in freshwater aquatic environments." *Environmental Science & Technology*. Vol. 44, Iss. 24. November 2010 at 9364.
- 9 Verones et al. (2010) at 9364; Jebakumar, Jebarathnam Prince Prakash et al. "Impact of coastal power plant cooling system on planktonic diversity of a polluted creek system." *Marine Pollution Bulletin*. Vol. 133. August 2018 at 378 and 379.
- 10 Jebakumar et al. (2018) at 378 and 379; Kowalski, Kathiann M. "Harmful Lake Erie algal blooms worsened by power plant pollution." *Energy News Network*. January 25, 2016.
- 11 Neuhauser (2019).
- 12 *Ibid.*
- 13 Singer, Stephen. "Millstone to seek permission to use warmer water for cooling." *Associated Press*. February 19, 2013.
- 14 Food & Water Watch analysis of 2017 Form EIA-860 Data — Schedule 3, "Generator Data" (Operable Units Only). Energy Information Administration. Available at <https://www.eia.gov/electricity/data/eia860/>. Accessed July 2019; U.S. Nuclear Regulatory Commission (NRC). "Reactor License Renewal." October 2018 at 1.
- 15 Dunn, Darrell S. et al. NRC. Office of Nuclear Regulatory Research. "Containment Liner Corrosion Operation Experience Summary: Technical Letter Report — Revision 1." April 2, 2011 at v and vi; Donn, Jeff. "Part I: AP Impact: US nuke regulators weaken safety rules." *Associated Press*. June 20, 2011.
- 16 Donn (June 21, 2011).
- 17 *Ibid.*
- 18 *Ibid.*
- 19 Dewar, Dale et al. "Uranium mining and health." *Canadian Family Physician*. Vol. 59, Iss. 5. May 2013 at 469; Jacobs, Jeremy P. "Enviros claim 'severe' flooding at uranium mine." *E&E News*. August 21, 2019.
- 20 Jacobs (2019).
- 21 NRC. "Uranium Mill Tailings." October 2016 at 1; NRC. "Uranium Enrichment." March 2016 at 1; Brugge, Doug and Virginia Buchner. "Health effects of uranium: New research findings." *Reviews on Environmental Health*. Vol. 26, Iss. 4. December 1, 2011 at 233; NRC. "Three Mile Island Accident." June 2018 at 1 and 2.
- 22 Gilbert, Samuel. "Church Rock, America's forgotten nuclear disaster, is still poisoning Navajo lands 40 years later." *Vice News*. August 12, 2019.

