Nuclear power and environmental injustice

Received: 22 July 2023 | Accepted: 23 August 2023

DOI: 10.1002/wene.498

PERSPECTIVE

WIREs ENERGY AND ENVIRONMENT WILEY

Nuclear power and environmental injustice

Johanna Höffken[1] | M. V. Ramana[2]

[1]School of Innovation Sciences, Eindhoven University of Technology, Eindhoven, The Netherlands

[2]School of Public Policy and Global Affairs, University of British Columbia, Vancouver, British Columbia, Canada

Correspondence
M. V. Ramana, School of Public Policy and Global Affairs, University of British Columbia, Vancouver, Canada.
Email: m.v.ramana@ubc.ca

Edited by: John Byrne, Associate Editor and Peter Lund, Editor-in-Chief

Abstract

Policy makers around the world have been advocating for an expansion of nuclear energy as a way to mitigate climate change, putting in place financial and political incentives for building new reactors and associated facilities. At the same time, policy makers have also been emphasizing the importance of incorporating justice considerations while decarbonizing. The two are not compatible because of the environmental injustices inflicted by the chain of processes required to generate electricity at nuclear power plants. These injustices are a result of the radioactive nature of the waste materials produced at each step of the nuclear fuel chain. Some of these materials remain hazardous for tens of thousands of years. In addition, nuclear facilities face the ever present risk of catastrophic accidents which can contaminate large tracts of land, rendering them uninhabitable for decades if not centuries. These consequences disproportionately fall on Indigenous Peoples and other disempowered communities, as well as non-human entities. Such impacts are overlooked in our current socio-political system committed to growth and a techno-economic approach to dealing with any challenges to its continued existence.

This article is categorized under:

Human and Social Dimensions > Energy and Climate Justice
Energy and Power Systems > Energy Infrastructure

KEYWORDS

environmental justice, nuclear colonialism, nuclear energy, radioactive waste

1 | INTRODUCTION

In June 2023, four Indigenous First Nations leaders called on the Canadian government to abandon a plan to build a storage facility for radioactive nuclear waste at the Canadian Nuclear Laboratories in Chalk River, near the Ottawa River or Kichi Sibi (Cimellaro, 2023). "As leaders and as people here today, it is our responsibility to preserve and protect Mother Earth for future generations. We cannot risk the destruction of land and water, which sustains life for all beings," said Lisa Robinson, Grand Chief of the Algonquin Nation Secretariat ("Algonquin First Nations Oppose Nuclear Waste Site on Their Unceded Territory," Madawaska Valley Current, 2023). The responsibility to preserve and protect for future generations that these Indigenous leaders talked about reflects why the waste associated with nuclear energy necessarily entails environmental injustice.

Considering the injustices associated with nuclear energy is particularly important at this juncture because policy makers in multiple countries have been advocating an expansion of the technology to mitigate climate change. In the EU taxonomy for sustainable activities, for example, nuclear power can, under certain conditions, be part of the energy options to meet climate change adaptation and mitigation objectives.

In a reminder of the old cliché about the left hand not knowing what the right hand is doing, this advocacy for nuclear power is happening alongside an increased emphasis on incorporating justice considerations into energy policy and decision-making. For example, in one of the first executive orders issued after he took office, U.S. President Joe Biden committed to "make environmental justice a central mission of federal agencies"; the President announced that every "federal agency must take into account environmental health impacts on communities and work to prevent those negative impacts. Environmental justice will be the mission of the entire government woven directly into how we work with state, local, tribal, and territorial governments" (Nilsen, 2023).

But as we argue in this perspective, these two goals are incompatible because nuclear power is incompatible with the proclaimed aims for justice. As a technology for generating electricity that also produces environmental injustices, nuclear power does not fit with any idea of a responsible and cleaner energy system. Nuclear power is also intimately tied with the technology used in the production of nuclear weapons, and the environmental impacts of the associated processes (see, for example, Makhijani et al., 1995), raise their own set of justice concerns. We do not delve into these so as to limit the scope of this piece.

2 | THEORETICAL BACKGROUND

The concept of environmental justice is a key way in which justice concerns have been discussed in the context of energy technologies, including nuclear power. The emergence of the term is linked to social movements of the 1980s in the United States. Opposition to toxic waste disposal in mainly African-American, underprivileged neighborhoods brought the broader issue of unequal distribution of environmental harms and risks into societal and academic focus (Bullard, 1990, 1994). Since then, discourse and literature on environmental justice have evolved substantially. Environmental justice as an analytical lens has been applied to a broader range of topics, including energy, food, land use, or water, and has expanded in geographical scope (Schlosberg, 2013). Alongside this expansion of scope has been an increase in conceptual nuance; Schlosberg and Collins find that environmental justice scholars address not just distributive inequities, but also a "lack of recognition, disenfranchisement and exclusion, and, more broadly, an undermining of the basic needs, capabilities, and functioning of individuals and communities" (Schlosberg & Collins, 2014, p. 361).

Such environmental justice insights led social science and humanities scholars working in the field of energy to initiate a discourse on energy justice (McCauley et al., 2013; Sovacool & Dworkin, 2014), which has grown considerably over the past decade (Jenkins et al., 2021), also attracting conceptual and normative critiques (e.g., Wood, 2023). Using the example of nuclear power in South Korea, Lee and Byrne (2019) point out that energy justice scholarship will benefit from paying "attention to underlying economic and political structures and institutions" that are important for understanding the production of systemic energy injustices (p. 2). Following on these authors' arguments, we further substantiate some of the specific social injustices wrought by nuclear power projects.

Our analysis also relates to intergenerational injustices, that is, potential harms being imposed on future generations of humans. This was one of the concerns emphasized by the four Indigenous First Nations leaders in their objections to the waste storage facility near Ottawa. Such harms have gained special attention in the discourse on environmental and climate justice (Newell et al., 2021; Schlosberg & Collins, 2014), and in the case of nuclear power (Taebi et al., 2012).

We also briefly introduce understandings of justice that decenter humans and individuals (Agyeman, 2005; Tschakert et al., 2021), and thus linking to broader discussions on non-anthropocentric ethics (Nolt, 2011). These understandings are less explored in the literature on nuclear energy.

Yet, our aim is less theoretical than it is topical. We live in a time of a continually deteriorating climate. And the nuclear industry and its supporters have used the concern over the climate to promote building a new generation of nuclear power plants, including so-called small modular reactors. These reactors, too, create the same set of risks and impacts as large reactors (Ramana, 2021; Ramana & Mian, 2014). Within this backdrop, arguments in favor of nuclear power have gained traction, ignoring considerations of justice. Our perspective is also intended to address this lacuna.

3 | NUCLEAR POWER FUEL CHAIN

Producing nuclear energy requires a long chain of processes, both before a nuclear reactor actually generates electricity and well after the reactor has stopped operating. This chain of processes produces multiple streams of radioactive waste materials, which is illustrated in Figure 1 for the case of France (Schneider & Marignac, 2008). These waste streams range in the concentrations of radioactive materials contained in them, from very low values in Very Low Level Waste (VLLW) all the way to extremely large values in High Level Waste (HLW).

The chain starts with mining uranium. Uranium, being radioactive, is never found in isolation but alongside many elements produced when uranium decays (Eisenbud & Gesell, 1997). Examples include radioactive elements like radium-226, polonium-210, and, especially, radon-222 (a gas) and its decay products ("daughters").

In the next step of the chain, the mined ore is chemically processed to separate the uranium from other parts of the ore. This process creates large quantities of wastes, usually called mill tailings, because the typical amount of uranium in the ore is quite low. These mail tailings are often contaminated with toxic heavy metals, such as molybdenum, arsenic, and vanadium, and with radioactive materials, principally thorium-230 and radium-226 (Makhijani et al., 1995).

In many countries, the nuclear reactor designs currently operating require fuel made with a higher concentration of uranium-235, the fissile component of uranium, than the 0.7 percent fraction of uranium-235 found in naturally occurring uranium. This requires the mined and processed uranium to be enriched in the uranium-235 content, for example, by using a uranium centrifuge plant. The leftover material has a lower concentration of uranium-235 and is known as depleted uranium—a term that became familiar after the U.S. attacks on Iraq using munitions made of this material and reports about a Gulf War syndrome among soldiers that is, at least in part, related to the health impacts of breathing in uranium dust.

Enriched uranium is fabricated into fuel for reactors, and it is in the form of fuel that the uranium, and the radioactive materials produced when this uranium fissions, will spend several decades—as fuel in the nuclear reactor and then

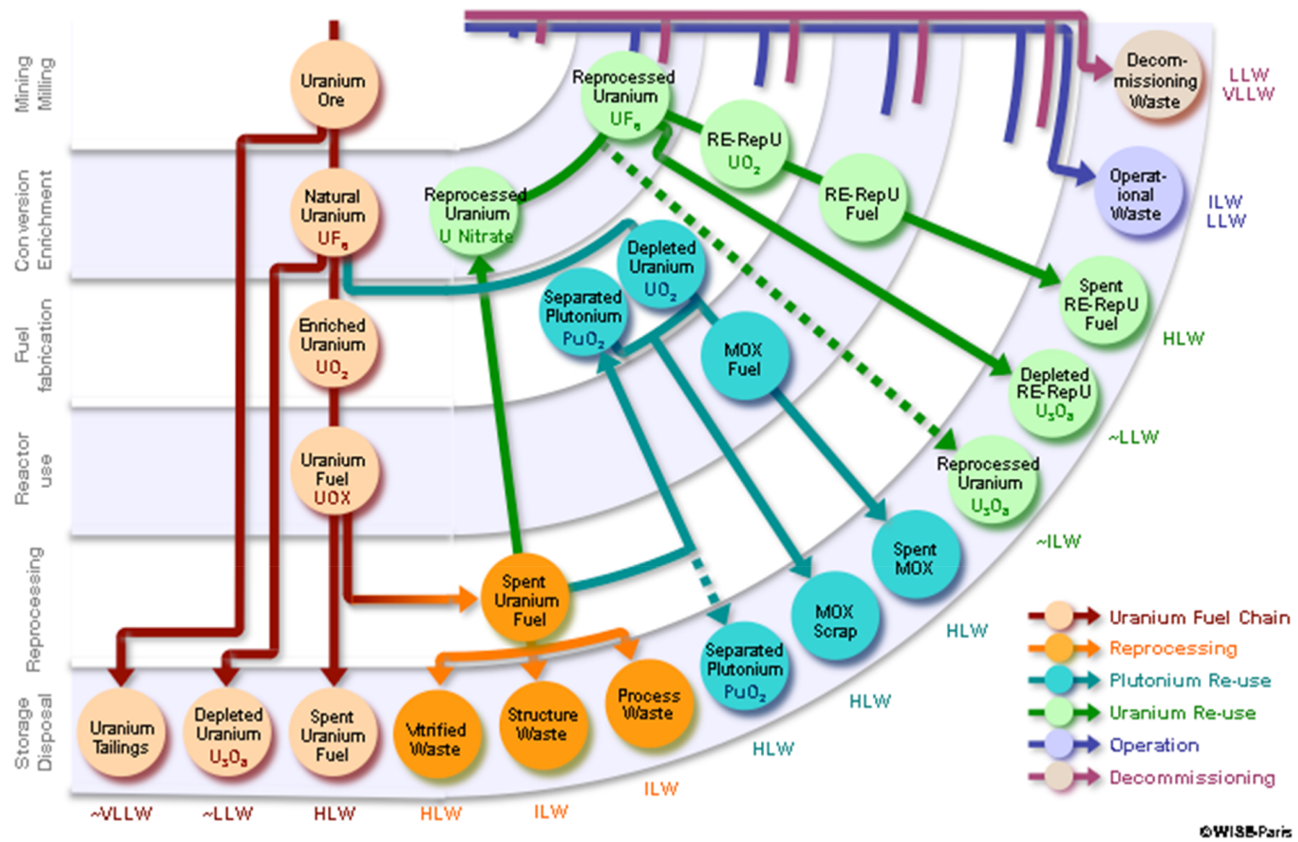

FIGURE 1 Generation of different radioactive-waste streams by nuclear power in France *Source*: WISE-Paris, reproduced in Schneider and Marignac (2008).

subsequently in pools of water meant to cool the radioactive spent fuel. If all goes according to plans, this would be followed by these materials being buried in a storage facility of some kind.

But not all of the radioactive materials produced in a nuclear reactor goes into a repository. The nuclear fission process also produces gaseous and liquid elements that are released into the environment. Such liquid and gaseous wastes include radioactive materials such as tritium (Makhijani, 2023), a radioactive isotope of hydrogen, and noble gases like Argon-41 (Berg, 2004).

Some countries like France do not store the irradiated spent fuel from reactors as such. Instead, they chemically process this spent fuel and extract plutonium (*Plutonium Separation in Nuclear Power Programs: Status, Problems, and Prospects of Civilian Reprocessing Around the World*; International Panel on Fissile Material, 2015). This plutonium is to be used to fuel other reactors, but there is also the danger that it can be used to make nuclear weapons.

Reprocessing also has a major impact on the problem of dealing with radioactive waste. The chemical process used results in multiple radionuclides being extracted from the solid spent fuel and added to liquid and gaseous waste streams. Because of the huge volumes of these waste streams, they are often released into the atmosphere or water bodies like oceans and rivers (NRPA, 2002; *Plutonium Separation in Nuclear Power Programs: Status, Problems, and Prospects of Civilian Reprocessing Around the World*; International Panel on Fissile Material, 2015).

Dealing with all of these wastes is problematic because they are radioactive. Exposure to radiation is hazardous to health, even at low levels (Beyea, 2012; National Research Council, 2006). Therefore, when people come into contact with these wastes, they are at higher risk of developing cancers and a range of other health effects (Little et al., 2023; Richardson et al., 2023). A particular complication is that some of these radioactive substances have extremely long half-lives, and remain hazardous for hundreds of thousands of years.

All of these environmental impacts are made worse by the inherent risk of severe accidents associated with nuclear facilities. Such accidents could result in releases of radioactive materials into the biosphere, as exemplified by Chernobyl and Fukushima, as well as a host of others that came close to such an outcome (Brown, 2019; Kastchiev et al., 2007; Lochbaum et al., 2014; Smith, 2006). Because of the inherent technical characteristics of nuclear power plants, first clarified by sociologist Charles Perrow (1984), it is impossible to predict in advance what kind of accident sequences could occur. All nuclear plants, small and large, can undergo accidents, which could result in widespread radioactive contamination.

4 | DISCUSSION

From its inception, nuclear power has been critiqued extensively, not only on techno-economic grounds but also regarding the manifold social and environmental injustices this technology is prone to bring about. Since the grievances caused by nuclear power cannot be categorized into self-contained analytical labels, we do not try to undertake a comprehensive classification of these injustices.

The nuclear fuel chain produces enormous quantities of hazardous waste, all the way from the mining of uranium all the way through the vast amounts of spent fuel nuclear power plants have to manage for decades. The unimaginably long half-lives of the various waste substances means that there is necessarily intergenerational injustice: people not yet born will inherit this hazardous waste and the associated challenges, but they will not benefit in any way from our generation's use of nuclear reactors to produce electricity. Even if these wastes are stored in geological repositories, the proposed management method that is currently most widely accepted, there is no way of knowing whether they will prevent radioactive materials leaking out into the water and earth over the epochal time periods for which they will remain hazardous (Ramana, 2018).

The nuclear waste produced through mining is also inextricably linked to other social injustices. Much of the uranium that has been mined around the world has come from areas occupied by Indigenous peoples, including in Australia, in Canada, in India, and in the United States (Kuletz, 1998; Eichstaedt, 1994; Gilles, 1996; Green, 2016; van Wyck, 2010; Iyko Day, 2022; Jarding, 2011; Gupta, 2023). Indigenous peoples have suffered incalculable health consequences as a result of these activities, for example, the Navajo nation in the United States (Brugge et al., 2007; Brugge & Goble, 2002).

The siting of uranium mining is related to the concept of "peripheralization," which describes how remote spaces with socio-economically marginalized communities have come to be the main sites and bearers of environmental risk (Blowers & Leroy, 1994). The process has also been related to what scholars have termed "radioactive colonialism" (LaDuke & Churchill, 1985), or "nuclear colonialism" (Kuletz, 1998), which Daniel Endres has described as "a system of domination through which governments and corporations target indigenous peoples and their lands to maintain the nuclear production process" (Endres, 2009, p. 40). The routine operations of nuclear plants cause deep social injustices by harming "ethnic and racialized people, including differences of gender, age, class, and their future generations" (Hanaček & Martinez-Alier, 2022, p. 971).

The nuclear enterprise is firmly anchored within a growth-oriented, techno-economic paradigm, in which profits are privatized and costs and risks are socialized. Whether it is during routine operation or in the event of an accident, it is "geographically remote, economically marginal, politically powerless" (Park & Sovacool, 2018, p. 686) communities that carry the main burdens of nuclear power.

The manifold social injustices caused by nuclear power have been well-studied for decades. A more recent direction in conceptualizing justice has been considering the non-human realm, including animals and plants (e.g., Sheikh, 2019). The concept of multispecies justice, which emphasizes relational, co-existing forms of human and non-human interactions, away from "human exceptionalism" (Tschakert et al., 2021, p. 3), has been gaining importance. Though this justice lens has not yet been applied to the case of nuclear power, the nuclear fuel chain's devastating impacts on wider socio-ecological systems have been widely studied, especially in areas around sites of major accidents like Chernobyl and Fukushima (e.g., Mousseau, 2021; Mousseau & Møller, 2020).

None of the injustices sketched above should be surprising. It should equally not be surprising that a socio-political system committed to growth and a techno-economic approach to dealing with any challenges to its continued existence will overlook these impacts. Those who promote nuclear power as the answer to the pressing challenges of climate change are often those who disproportionately benefit from such a system (Ramana & Jeffery, 2022). For the rest of us, this history of injustices and the inevitability of more of the same if nuclear power were to expand globally should be a strong reason to reject this option as a way to deal with climate change.

AUTHOR CONTRIBUTIONS

M. V. Ramana: Conceptualization (equal); methodology (equal); writing – original draft (equal); writing – review and editing (equal). **Johanna Höffken:** Conceptualization (equal); methodology (equal); writing – original draft (equal); writing – review and editing (equal).

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

ORCID

Johanna Höffken https://orcid.org/0000-0001-7615-9382
M. V. Ramana https://orcid.org/0000-0003-1332-930X

RELATED WIREs ARTICLE

Technical and social problems of nuclear waste

REFERENCES

Agyeman, J. (2005). *Sustainable communities and the challenge of environmental justice*. NYU Press.

Berg, D. (2004). Radionuclides in the environment. In R. Tykva & D. Berg (Eds.), *Man-made and natural radioactivity in environmental pollution and radiochronology* (pp. 13–69). Springer.

Beyea, J. (2012). The scientific jigsaw puzzle: Fitting the pieces of the low-level radiation debate. *Bulletin of the Atomic Scientists*, *68*(3), 13–28. http://bos.sagepub.com/content/68/3/13

Blowers, A., & Leroy, P. (1994). Power, politics and environmental inequality: A theoretical and empirical analysis of the process of 'peripheralisation'. *Environmental Politics*, *3*(2), 197–228. https://doi.org/10.1080/09644019408414139

Brown, K. (2019). *Manual for survival: A Chernobyl guide to the future*. W.W. Norton & Company.

Brugge, D., Benally, T., & Yazzie-Lewis, E. (Eds.). (2007). *The Navajo people and uranium mining*. University of New Mexico Press.

Brugge, D., & Goble, R. (2002). The history of uranium mining and the Navajo people. *American Journal of Public Health*, *92*(9), 1410–1419.

Bullard, R. D. (1990). *Dumping in Dixie: Race, class, and environmental quality*. Westview Press.

Bullard, R. D. (1994). *Unequal protection: Environmental justice and communities of color*. Sierra Club Books.

Cimellaro, M. (2023). 'We need to wake up': Algonquin leaders sound alarm over planned nuclear waste facility near Ottawa River. National Observer. https://www.nationalobserver.com/2023/06/20/news/algonquin-leaders-sound-alarm-over-planned-nuclear-waste-facility

Day, I. (2022). Nuclear Antipolitics and the queer art of logistical failure. In S. Koshy, L. M. Cacho, J. A. Byrd, & B. J. Jefferson (Eds.), *Colonial racial capitalism*. Duke University Press.

Eichstaedt, P. H. (1994). *If you poison us: Uranium and native Americans* (Vol. 1st). Red Crane Books.

Eisenbud, M., & Gesell, T. F. (1997). *Environmental radioactivity: From natural, industrial, and military sources*. Academic Press.

Endres, D. (2009). The rhetoric of nuclear colonialism: Rhetorical exclusion of American Indian arguments in the Yucca Mountain nuclear waste siting decision. *Communication and Critical/Cultural Studies*, *6*(1), 39–60. https://doi.org/10.1080/14791420802632103

Gilles, C. (1996). No one ever told us: Native Americans and the great uranium experiment. In J. Byrne & S. M. Hoffman (Eds.), *Governing the atom: The politics of risk* (pp. 103–125). Transaction Publishers.

Green, J. (2016). Radioactive waste and the nuclear war on Australia's aboriginal people. *The Ecologist*. https://theecologist.org/2016/jul/01/radioactive-waste-and-nuclear-war-australias-aboriginal-people

Gupta, P. (2023). Reason and risk: Challenging the expert and public divide in the risk debates on uranium Mining in India. In J. D. Hamblin & L. M. Richards (Eds.), *Making the unseen visible: Science and the contested histories of radiation exposure*. Oregon State University Press.

Hanaček, K., & Martinez-Alier, J. (2022). Nuclear supply chain and environmental justice struggles in soviet and post-soviet countries. *Post-Communist Economies*, *34*(7), 966–994. https://doi.org/10.1080/14631377.2021.1943917

International Panel on Fissile Material. (2015). Plutonium separation in nuclear power programs: Status, problems, and prospects of civilian reprocessing around the world. http://fissilematerials.org/library/rr14.pdf

Jarding, L. J. (2011). Uranium Activities' impacts on Lakota territory. *Indigenous Policy Journal*, *22*(2), 1–21.

Jenkins, K. E. H., Sovacool, B. K., Mouter, N., Hacking, N., Burns, M.-K., & McCauley, D. (2021). The methodologies, geographies, and technologies of energy justice: A systematic and comprehensive review. *Environmental Research Letters*, *16*(4), 043009. https://doi.org/10.1088/1748-9326/abd78c

Kastchiev, G., Kromp, W., Kurth, S., Lochbaum, D., Lyman, E., Sailer, M., & Schneider, M. (2007). *Residual risk: An account of events in nuclear power plants since the Chernobyl accident in 1986*. The Greens/European Free Alliance.

Kuletz, V. (1998). *The tainted desert: Environmental ruin in the American West*. Routledge.

LaDuke, W., & Churchill, W. (1985). Native America: The political economy of radioactive colonialism. *The Journal of Ethnic Studies*, *13*(3), 107–132.

Lee, J., & Byrne, J. (2019). Expanding the conceptual and analytical basis of energy justice: Beyond the three-tenet framework. *Frontiers in Energy Research*, *7*, 1–10.

Little, M. P., Azizova, T. V., Richardson, D. B., Tapio, S., Bernier, M.-O., Kreuzer, M., Cucinotta, F. A., Bazyka, D., Chumak, V., Ivanov, V. K., Veiga, L. H. S., Livinski, A., Abalo, K., Zablotska, L. B., Einstein, A. J., & Hamada, N. (2023). Ionising radiation and cardiovascular disease: Systematic review and meta-analysis. *BMJ*, *380*, e072924. https://doi.org/10.1136/bmj-2022-072924

Lochbaum, D., Lyman, E., Stranahan, S. Q., Scientists, T. U., & of C. (2014). *Fukushima: The story of a nuclear disaster*. New Press.

Madawaska Valley Current. (2023). Algonquin First Nations oppose nuclear waste site on their unceded territory. https://madvalleycurrent.com/2023/06/21/algonquin-first-nations-oppose-nuclear-waste-site-on-their-unceded-territory/

Makhijani, A. (2023). *Exploring tritium dangers*. Politics & Prose.

Makhijani, A., Hu, H., Yih, K., & International Physicians for the Prevention of Nuclear War, & Institute for Energy and Environmental Research (Takoma Park Md.). (1995). *Nuclear wastelands: A global guide to nuclear weapons production and its health and environmental effects*. MIT Press.

McCauley, D., Heffron, R., Stephan, H., & Jenkins, K. (2013). Advancing energy justice: The triumvirate of tenets. *International Energy Law Review*, *32*, 107–110.

Mousseau, T. A. (2021). The biology of Chernobyl. *Annual Review of Ecology, Evolution, and Systematics*, *52*(1), 87–109. https://doi.org/10.1146/annurev-ecolsys-110218-024827

Mousseau, T. A., & Møller, A. P. (2020). Plants in the light of ionizing radiation: What have we learned from Chernobyl, Fukushima, and other "hot" places? *Frontiers in Plant Science*, *11*, 1–9.

National Research Council. (2006). *Health risks from exposure to low levels of ionizing radiation: BEIR VII, phase 2*. National Academies Press.

Newell, P., Srivastava, S., Naess, L. O., Torres Contreras, G. A., & Price, R. (2021). Toward transformative climate justice: An emerging research agenda. *WIREs Climate Change*, *12*(6), e733. https://doi.org/10.1002/wcc.733

Nilsen, E. (2023). *Biden announces new environmental justice initiatives*. CNN.

Nolt, J. (2011). Nonanthropocentric climate ethics. WIREs. *Climate Change*, *2*(5), 701–711. https://doi.org/10.1002/wcc.131

NRPA. (2002). *Discharges of radioactive waste from the British reprocessing plant near Sellafield*. Nowegian Radiation Protection Authority.

Park, J., & Sovacool, B. K. (2018). The contested politics of the Asian atom: Peripheralisation and nuclear power in South Korea and Japan. *Environmental Politics*, *27*(4), 686–711. https://doi.org/10.1080/09644016.2018.1439436

Perrow, C. (1984). *Normal accidents: Living with high risk technologies*. Basic Books.

Ramana, M. V. (2018). Technical and social problems of nuclear waste. *Wiley Interdisciplinary Reviews: Energy and Environment*, *7*(4), e289. https://doi.org/10.1002/wene.289

Ramana, M. V. (2021). Small modular and advanced nuclear reactors: A reality check. *IEEE Access*, *9*, 42090–42099. https://doi.org/10.1109/ACCESS.2021.3064948

Ramana, M. V., & Jeffery, C. (2022). Bill Gates and techno-fix delusions. Against the Current, 220. https://againstthecurrent.org/atc220/bill-gates-and-techno-fix-delusions/

Ramana, M. V., & Mian, Z. (2014). One size doesn't fit all: Social priorities and technical conflicts for small modular reactors. *Energy Research & Social Science*, *2*, 115–124. https://doi.org/10.1016/j.erss.2014.04.015

Richardson, D. B., Leuraud, K., Laurier, D., Gillies, M., Haylock, R., Kelly-Reif, K., Bertke, S., Daniels, R. D., Thierry-Chef, I., Moissonnier, M., Kesminiene, A., & Schubauer-Berigan, M. K. (2023). Cancer mortality after low dose exposure to ionising radiation in workers in France, the United Kingdom, and the United States (INWORKS): Cohort study. *BMJ*, *382*, e074520. https://doi.org/10.1136/bmj-2022-074520

Schlosberg, D. (2013). Theorising environmental justice: The expanding sphere of a discourse. *Environmental Politics*, *22*(1), 37–55. https://doi.org/10.1080/09644016.2013.755387

Schlosberg, D., & Collins, L. B. (2014). From environmental to climate justice: Climate change and the discourse of environmental justice. *WIREs Climate Change*, *5*(3), 359–374. https://doi.org/10.1002/wcc.275

Schneider, M., & Marignac, Y. (2008). Spent nuclear fuel reprocessing in France. International Panel on Fissile Materials. www.ipfmlibrary.org/rr04.pdf

Sheikh, S. (2019). More-than-human cosmopolitics. In M. Hlavajova & W. Maas (Eds.), *Propositions for non-fascist living* (pp. 125–140). MIT Press.

Smith, B. (2006). *Insurmountable risks: The dangers of using nuclear power to combat global climate change*. IEER Press.

Sovacool, B. K., & Dworkin, M. H. (2014). *Global energy justice: Problems, principles, and practices*. Cambridge University Press.

Taebi, B., Roeser, S., & van de Poel, I. (2012). The ethics of nuclear power: Social experiments, intergenerational justice, and emotions. *Energy Policy*, *51*, 202–206. https://doi.org/10.1016/j.enpol.2012.09.004

Tschakert, P., Schlosberg, D., Celermajer, D., Rickards, L., Winter, C., Thaler, M., Stewart-Harawira, M., & Verlie, B. (2021). Multispecies justice: Climate-just futures with, for and beyond humans. *WIREs Climate Change*, *12*(2), e699. https://doi.org/10.1002/wcc.699

van Wyck, P. (2010). *The highway of the atom*. McGill-Queen's University Press.

Wood, N. (2023). Problematising energy justice: Towards conceptual and normative alignment. *Energy Research & Social Science*, *97*, 102993. https://doi.org/10.1016/j.erss.2023.102993

How to cite this article: Höffken, J., & Ramana, M. V. (2024). Nuclear power and environmental injustice. *WIREs Energy and Environment*, *13*(1), e498. https://doi.org/10.1002/wene.498