

# Waste Matters: Nuclear Technopolitics and Futures at the Waste Isolation Pilot Plant (WIPP) in New Mexico

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This article makes the case for nuclear weapons waste as an integral part of the US nuclear weapons complex and of international nuclear politics more broadly. Nuclear waste is not simply a by-product or issue of disposal, as assumed in much IR and security literature. Instead, waste creates and maintains socioeconomic drivers and narratives that have a productive power and enable particular nuclear futures. The article develops a three-part argument to support its claims about nuclear weapons waste arguing that: the political and socioeconomic impacts of nuclear weapons waste are deeply important at multiple levels; waste infrastructures are sites of contestation of nuclear futures; and the political dynamics of these impacts are obscured by the dynamics of technopolitics. The article grounds this argument in interviews collected during fieldwork on the US nuclear weapons waste complex in New Mexico, focusing specifically on the Waste Isolation Pilot Plant (WIPP), the only permanent geologic disposal site for nuclear weapons waste in the United States. The dynamics around this site are in one way uniquely American, and specifically New Mexican, but they also can be used as one starting point to illuminate specific impacts of living in a world of nuclear weapons.

Cet article affirme que les déchets des armes nucléaires font partie intégrante du complexe des armes nucléaires américain et de la politique nucléaire internationale au sens large. Les déchets nucléaires ne se résument pas à un sous-produit ou une question d'élimination, comme le suppose la majorité de la littérature en RI et sur la sécurité. Ces déchets créent et entretiennent plutôt des facteurs socioéconomiques et des récits dotés d'un pouvoir productif et qui rendent possibles des avènements nucléaires particuliers. L'article développe une argumentation en trois parties pour justifier son propos quant aux déchets des armes nucléaires, en affirmant que : les effets politiques et socioéconomiques des déchets des armes nucléaires revêtent une grande importance à plusieurs niveaux, les infrastructures de gestion des déchets sont des sites de contestation des avènements nucléaires et les dynamiques politiques de ces effets sont masquées par les dynamiques de la technopolitique. L'article ancre son propos dans des entretiens recueillis lors d'un travail de terrain sur le complexe des déchets d'armes nucléaires américain au Nouveau-Mexique, en se concentrant en particulier sur l'usine Waste Isolation Pilot Plant (WIPP), le seul site d'élimination géologique permanent pour les déchets d'armes nucléaires aux États-Unis. D'un côté, les dynamiques qui entourent ce site sont exclusivement américaines, et plus précisément propres au Nouveau-Mexique, mais elles peuvent aussi servir de point de départ afin de mettre en lumière des conséquences spécifiques de la vie dans un monde où les armes nucléaires existent.

Este artículo argumenta que los desechos de armas nucleares son una parte integral del complejo de armas nucleares de Estados Unidos y de la política nuclear internacional en general. Los desechos nucleares no son simplemente un subproducto o un problema de eliminación, como se asume en gran parte de la literatura en materia de RRII y seguridad. En cambio, los desechos crean y mantienen estructuras y narrativas socioeconómicas que tienen un poder productivo y permiten futuros nucleares específicos. El artículo desarrolla una hipótesis, formada por tres partes, con el fin de respaldar nuestras afirmaciones con respecto a los desechos de armas nucleares. En ese sentido, el artículo argumenta que: los impactos políticos y socioeconómicos de los desechos de armas nucleares son profundamente relevantes a múltiples niveles, las infraestructuras de desechos son espacios de disputa sobre los futuros nucleares y las dinámicas políticas de estos impactos están oscurecidas por las dinámicas de la tecnopolítica. El artículo fundamenta este argumento a través de entrevistas recopiladas durante el trabajo de campo sobre el complejo de desechos de armas nucleares de Estados Unidos en Nuevo México, centrándose específicamente en la Planta Piloto para el Aislamiento de Residuos (WIPP, por sus siglas en inglés), el único emplazamiento de disposición geológica permanente de desechos de armas nucleares en Estados Unidos. Las dinámicas que rodean a este emplazamiento son, de alguna manera, característicamente estadounidenses, y específicamente de Nuevo México, pero también pueden usarse como un punto de partida que nos ayude a arrojar luz con respecto a aquellos impactos específicos que conlleva el hecho de vivir en un mundo con armas nucleares.

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### Introduction

This article makes the case for nuclear weapons waste as an integral part of the US nuclear weapons complex and of international nuclear politics more broadly. Waste is not simply a by-product of weapons production but is itself a producer of nuclear weapons systems that needs to be actively investigated and addressed. I argue that waste matters and develop a technopolitical and narrative framing grounded in work across disciplines, including sociology, geography, and discard studies through which to incorporate waste into our understandings of a nuclear weapons complex.<sup>1</sup> This claim is supported by fieldwork on the sites of US nuclear weapons waste complex in New Mexico, focusing specifically on the Waste Isolation Pilot Plant (WIPP) in the southeast of the state. WIPP is the only permanent geologic disposal site for nuclear weapons waste in the United States and a political success story from the perspectives of local officials and the DOE, but still a contentious issue in New Mexico (Genay 2019). The article argues that WIPP provides insight into nuclear weapons politics in the United States in terms of the dynamics between county, state, and federal level politics and contests around class and political allegiance.

Studying WIPP also illuminates and challenges the boundaries of international nuclear politics and what it includes/excludes. By combining literature on waste and discard studies, technopolitics, and nuclear infrastructure, the article claims that waste creates and maintains socioeconomic drivers and narratives that have a productive power within global nuclear weapons politics, enabling particular nuclear futures. Nuclear weapons waste is not simply a question of disposal and thus of endings. As Gabrys, drawing on Serres, writes: “We cannot know systems without their dirt . . . which in many ways points to the necessity of more fully incorporating dirt into environmental understandings not to cast it into hypothetical spaces of

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<sup>1</sup>The term nuclear complex has been variously defined. I take a broad definition as the “materials, competencies, meanings, institutions and money flows that are necessary to enable a state to safely and securely design, develop, manufacture, deploy, deliver, maintain and decommission nuclear weapons” (Ritchie 2024, 4).

final burial, but to reveal the generative and dynamic role it plays within natural cultural ecologies” (2009, 670–1). If we take this approach to “dirt,” the perpetuation of a nuclear armed world both requires and is required by nuclear weapons waste. Waste, therefore, demands examination not just as a reason for the reduction of nuclear harms and nuclear disarmament, but as a component of nuclear weapons politics that needs to be actively investigated and addressed to achieve these goals. The article does not argue that WIPP can be connected to a separate realm of international nuclear weapons politics, but rather that the realm of international nuclear politics should be expanded to include WIPP and other waste sites. Places such as WIPP are sites of *international* nuclear politics.<sup>2</sup> Discard studies makes this general point about all types of waste as productive of their systems but, as work in urban studies has argued, nuclear weapons infrastructure is also unique in that its “product” is a potentially world-destroying system of mutually assured destruction. Nuclear sites thus generate a “planetary infrastructural totality via the risks nuclear technology poses” (Liubimau 2021, 18). Other nuclear things have been considered in this way, for example, Pouliot (2010) makes the case for nuclear warheads as objects that embody and prolong Cold War nuclear deterrence structures. If we are to take waste seriously as a part of the nuclear weapons complex rather than its outcome as this article argues, then the same applies here.

There have been sociologically informed approaches to nuclear weapons in the discipline of International Relations (IR) (e.g., Senn and Elhardt 2013; Bourne 2016). There is also relevant work on international political sociology (IPS) on questions of waste and the international (Acuto 2014) and the ability of infrastructure to “destabilize . . . the separations of state from society, politics from economics, and the national (internal) from the international (external)” (Bakonyi et al. 2025, 3). Such research has not yet engaged with nuclear weapons wastes and infrastructures. This article makes the case that such an engagement is valuable and necessary because IPS approaches can ground research that collapses and complicates the boundaries of local, national, and international nuclear weapons politics without subsuming them (Bigo and Walker 2007).

This article makes the case for WIPP as a productive site of international nuclear politics in three stages, firstly arguing that nuclear weapons waste has economic and sociopolitical impacts on the same scale as other parts of the nuclear weapons complex, and that these impacts are evident at the WIPP site. This claim is grounded in work on waste and discard studies that have conceptualized waste as having its own material objectivity that is not disposed of but maintains an economic, political, and social presence (O’Brien 1999). Waste therefore produces the systems of which it is part (Douglas 2003; Liboiron and Lepawsky 2022). The materiality of nuclear waste has deep political and socioeconomic implications for Carlsbad and the southeast of New Mexico in making it a nuclear place and that state of being nuclear, labeled by Hecht as “nuclearity” (2012), carries consequences. The article then argues that WIPP’s materiality and its making of Southeast New Mexico as a “nuclear” place has narrative consequences and (re)produces nuclear futures. The article uses Jessica Hurley’s (2020) literary studies development of nuclear infrastructures’ interplay with nuclear narratives and imaginaries. This reveals in distinctive ways the “multi-scalar and multi-temporal” (Kuletz 1998, 11) dynamics and contradictions at work in nuclear politics, in which spaces and timescales are objects of controversy and contestation. Yet if this is the case, why has waste been sidelined in discussions of nuclear weapons to date? The third point this article makes is that the technopolitics of nuclear waste are active in obscuring its impacts. Drawing on Gabrielle Hecht’s (2023) research on nuclear sites on the margins of nuclear com-

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<sup>2</sup>It should also be noted that sites of the nuclear complex in the United States are also international in that they involve relations with multiple American Indian tribal nations.

plexes and Vincent Ialenti's work on a 2014 accident at WIPP (2022), the article draws out the technopolitical dynamics at WIPP that obscure its wider implications.

The article's approach to waste as a producer not an outcome of global nuclear politics is so far underdeveloped in IR and security literature (Flahive et al. 2025). In work on nuclear strategy and deterrence, waste is often completely ignored as an element of nuclear weapons politics except for some discussion of the proliferation risks of high-level waste. Research that takes a critical perspective on nuclear weapons or that supports disarmament often acknowledges various forms of nuclear waste as an unfortunate and dangerous product of weapons production, a humanitarian danger, and a reason for abolition. Yet, waste is not grappled with as a source of the political challenges of disarmament politics.<sup>3</sup> For example, critical literature that contests nuclear deterrence has tended to do so as an "ideology" (Egeland 2021), "myth" (Wilson 2008), or "ontological discourse" (Ritchie 2022) and so has not to date theorized the role of nuclear weapons sites, and specifically waste sites, in maintaining nuclear weapons complexes and thus nuclear deterrence.<sup>4</sup> As such, these approaches acknowledge the importance and scale of issues of nuclear weapons waste, and its ethical implications, but still tend to categorize waste as a specific order of problem, one that occurs as a consequence of prior political contests and that then must be remedied.

There has therefore been a lack of sustained connection of the work on international nuclear politics to the valuable work outside IR on nuclear weapons waste sites. Such research includes Kuletz's work on the wasteland as a practice of environmental racism and nuclear colonialism as enabling the sacrifice of certain people and places (1998, also Voyles 2015). Gómez's work places the imposition of nuclear weapons production and its waste on the state of New Mexico in the context of multiple waves of colonialism (Gómez 2022). Authors such as Endres (2012) have analyzed the contest over and the ultimate failure of the proposed Yucca Mountain site in Nevada as a permanent repository for high-level nuclear waste. Communications scholars have engaged with the "legacies" (Taylor et al. 2005) of nuclear production and the "discursive containment" of debates over nuclear waste (Kinsella 2001, 2004). There is also an extensive literature on memory and communicating the long-enduring dangers of nuclear waste into the future (Keating and Storm 2023).

The article proceeds in five sections. The first and second set out the research methods, introduce the WIPP site, and give background on the specific type of nuclear waste under study in this article. The following three develop the article's three-part analysis of WIPP. The article concludes that nuclear weapons waste is not material that has come to the end of its use but material that continues to produce and reproduce forms of nuclear politics.

## Methods

I conducted 4 weeks of fieldwork in New Mexico in late 2023 for this article. This involved semi-structured interviews with twenty interviewees, mainly in person in Carlsbad, Albuquerque, and Santa Fe in New Mexico. I also spoke to three people online after the fieldwork. Interviews were with city and state officials, activists challenging nuclear activities and their impacts in New Mexico, current or former DOE employees, and Carlsbad residents. Most of the interviewees were directly or indirectly involved with the politics of WIPP and/or nuclear weapons activities in New Mexico, though some were local residents with less involvement. This means

<sup>3</sup>For example, the 2017 Treaty on the Prohibition of Nuclear Weapons (TPNW) does not mention waste in its preamble or clauses on remediation of nuclear harms. Exceptions include Jacobs (2022); Biswas (2014) provides a different perspective by arguing that it is possible to see the weapons themselves as waste and wasteful should deterrence actually hold. A recent forum in *International Feminist Journal of Politics* (2021) has also discussed links between different geographies of nuclear weapons contamination.

<sup>4</sup>Ritchie includes "material capabilities" in his discussion of nuclearism but focuses his analysis on discourse.

that the work focuses on a motivated and engaged core group with a lot of knowledge, though with varying perspectives. This selection of interviewees allowed me to examine how political contests over WIPP in particular and nuclear waste in New Mexico more broadly play out and on what terms. I manually coded these interviews on NVivo, identifying repeated themes and phrases from the transcripts and developing nodes based on these patterns.

In addition, I attended online public forums on WIPP that were organized as part of DOE's community engagement efforts and any other relevant political and government events. Finally, I read official documents on WIPP and waste by the DOE's Office of Environmental Management (EM), the New Mexico Environment Department, and the National Nuclear Security Administration (NNSA); reports by the Government Accountability Office, DOE budgets and associated documents; and policy and scientific reports on WIPP, waste management in general, and NNSA planning. I do not, however, claim full knowledge of the dynamics of New Mexico's complex nuclear history or understand the lifetimes of experiences of the various communities that have lived in a state that has borne much of the cost of nuclear weapons. My perspective is as an outsider, and my purpose is to argue that what happens at WIPP, while of course having important local consequences, is not simply a local or national issue.

### Introducing WIPP and Its Waste

The International Atomic Energy Agency (IAEA) places nuclear waste, understood as "radioactive material for which no further use is foreseen but still contains, or is contaminated with, radionuclides" (IAEA 2018), into six categories for the purposes of disposal. These are exempt [from requiring clearance] waste, very short-lived waste, very low-level waste, intermediate-level waste, and high-level waste (IAEA 2009). Disposal requirements range from landfill storage for very low-level waste to deep geologic storage for high-level waste such as spent nuclear fuel. This article focuses on Transuranic waste (TRU), the particular subset of nuclear waste that is disposed of at WIPP. TRU as a category is not used by the IAEA but is one developed by the United States "composed of man-made radioactive materials that are heavier than uranium (i.e., have an atomic number greater than 92), contain alpha-emitting radionuclides with half-lives greater than 20 years, and emit greater than 100 nanocuries per gram (nCi/g)" (USEPA). TRU is produced either from spent fuel or, more commonly in the United States, from the processing of plutonium in the production of nuclear weapons. While TRU has the long half-life associated with high-level waste, it does not necessarily have the very high radioactivity. This waste has commonly included objects that are contaminated by radioactive elements through, for example, the production processes of nuclear weapons. This article only deals with TRU waste from nuclear weapons production, which is what is stored at WIPP. This does not mean that I unquestioningly accept a clear military/civilian distinction that can create false binaries practically, politically, and morally between different forms of nuclear technology (Peoples 2016).

#### Carlsbad, Eddy County

The city of Carlsbad is in the Delaware Basin, which contains extensive deep salt formations created by the evaporation of an ancient shallow sea. In one of these formations, about 26 miles outside of the city and 660 m below the ground, is the WIPP. WIPP's waste panels are each made of seven rooms, 33 feet by 300 feet, dug out of the salt. Salt beds are considered a suitable place for nuclear waste disposal as over time the salt walls of the rooms will "creep" because of the material's ductile nature, encasing the nuclear waste within. WIPP is the only permanent geologic nuclear waste disposal site in the United States and is permitted for disposal of

TRU waste from US nuclear weapons plutonium production. WIPP does not accept low- and high-level waste or spent fuel but does accept mixed waste that has a hazardous component as well as a radiological one. As such, the site is regulated by both the Environmental Protection Agency (EPA) and the New Mexico Environment Department (NMED), which regulate the hazardous waste element. The state renews WIPP's permit every 5 years. WIPP began accepting waste in 1999 but shut down for 3 years in 2014 after a waste drum from Los Alamos erupted underground and burned for 2 hours, releasing radionuclides above ground that contaminated twenty-two people. The eruption happened because the wrong material was used to absorb liquids in the drum, an organic wheat-based cat litter called "Swheat Scoop" instead of inorganic clay litter (DOE 2015; Ialenti 2021).

The 1992 WIPP Land Withdrawal Act, which authorized the use of the land, did not specify a time limit for WIPP but a capacity limit (6.2 million cubic feet), though the text indicated a possible date for closure as 2024. Because of delays after the 2014 fire and changes to waste volume accounting practices, in 2023, WIPP had reached only 40 percent capacity, and recent permit documents suggest a closure date of 2083 (DOE Carlsbad Field Office 2024). The waste that goes into WIPP is generally termed "legacy waste" and traditionally this has been materials such as tools, clothing, and soil that were contaminated with plutonium and other transuranic elements from Manhattan Project and Cold War production sites. As a recent National Academy of Sciences (NAS) report noted, this is still how WIPP waste is presented publicly (NAS 2020). Yet the type of waste going into WIPP is changing. WIPP is now slated to take in diluted surplus plutonium (DSP) from the "dilute and dispose programme" (DOE 2023) as well as waste from new plutonium pit production at Los Alamos National Laboratory and Savannah River Site (DOE Carlsbad Field Office, 2024).<sup>5</sup> The NAS report on DSP claims that such a change has implications for the "social contract" that WIPP has established with the state of New Mexico and its residents. The report states that the "common presentation of WIPP TRU waste as modestly contaminated debris generated through defense activities related to nuclear weapons maintenance and development is incongruent with the characteristics of the DSP-TRU waste streams" (NAS 2020, 96). That report does not include the implications of new pit production waste, which change the purpose further as it is newly generated waste and not legacy waste.

The changing nature of WIPP waste and the changing timeline for closure adds to longer-term conflicts between WIPP supporters and opponents. This conflict is entrenched and links to wider geographical and political divides. Unlike a space such as the Hanford Nuclear Site in Washington where the waste was produced—for a time without knowledge or consent—WIPP became a part of the nuclear weapons complex after the city of Carlsbad's political leaders suggested that their land would be suitable to dispose of waste from elsewhere. Eric Morgan labels WIPP as a place of "nuclear maintenance" (2007, 114) that centers around discourses of economy, control, and isolation as opposed to a place of remediation like Hanford, which centers on contested understandings and practices of cleanup (Cram 2023). City leaders in Carlsbad were the main movers behind the WIPP facility and are supportive of the project (Saraç-Lesavre 2020). Much organized opposition to WIPP comes from groups in Albuquerque and Santa Fe in the north of the state. This creates resentment from those in Carlsbad who feel that it is their decision, not northern "antis," as one interviewee described them (Interview CO2). Meanwhile, those who are skeptical of WIPP and its future feel that "boosters" in Carlsbad are imposing this site for short-term localized gains onto a state that has already borne the brunt of the US nuclear weapons complex. Transportation provides another issue as waste is driven from multiple sites to New Mexico and across the state to the

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<sup>5</sup>This plan was changed by the Trump administration in May 2025 leading to uncertainty over the future of DSD.

WIPP site and those on or near the route have challenged the risks they say this creates.

### Waste Matter(s)

In order to grasp the position of waste as a part of international nuclear politics, I argue that it is necessary to accept that nuclear waste is not simply a byproduct or excess that can be disposed. Contrary to the IAEA definition above, nuclear waste has not reached the end of its “use.” O’Brien (1999) instead argues from a political economy perspective that waste has its own material objectivity that does not depart from the economic system any more than it departs from the physical space. O’Brien uses the term “wasting” to highlight waste’s objectivity and impact. Wasting is a “dynamic of social change, the elements of which drive technological innovation, instil and challenge social rights, roles and rules of access, encode cultural representations, and organize political hierarchies and regulatory frameworks” (1999, 270). As such, waste and wasting are a core and continuous part of an economic/political system, in this case, the system of nuclear weapons. According to this understanding waste “inhabits a world of values and transactions, inventions and discoveries: it motivates commercial innovation and political struggle” (1999, 277). It is not a transitory problem to be cleaned up before exiting the world but maintains an unending economic presence (1999, 280).

Mary Douglas writes that “[w]here there is dirt there is system. Dirt is the by-product of a systematic ordering and classification of matter, in so far as ordering involves rejecting inappropriate elements” (2003, 44). Similarly, the more recent field of discard studies asks the question “[w]ho and what must be gotten rid of for wider systems, structures, and cultures to persist and maintain themselves?” (Liboiron and Lepawsky 2022, 61). The system produced through nuclear “dirt” is that of global nuclear weapons and, as such, nuclear waste management is a core part of the maintenance of an international nuclear order. As such, nuclear waste sites are inherently sites of international nuclear politics. Taking this approach to weapons waste means we can engage with nuclear weapons production as a waste producing and consuming system, not simply in relation to the nuclear fuel cycle, but also in terms of political and economic systems that are underpinned by waste creation, management and disposal. Indeed, the idea of “disposal” implies an ending, but actually involves moving and concentrating of waste and its attendant risks to particular spaces (Murphy and Kuhn 2006, 195).

Nuclear waste, in the account here, is not an exceptional type of waste but rather the most extreme example of the argument “clearly and frighteningly, that dirt matters: that dirt and waste have their own material objectivity that is not merely their ‘out-placedness’” (O’Brien 1999, 280). This is different to accounts that claim nuclear waste as a “new form of waste,” one “whose toxicity requires a different conception of history and time” (Van Wyck 2005, 5). Nuclear waste’s timescales and possible harms are extreme but can be also understood in a context of, for example, “forever chemicals” and plastic waste when assessing the systems reproduced through their creation, movement and disposal. Yet there is also a specificity to nuclear weapons waste that includes its physical properties and extremes of duration and potential harm, but is driven also by discursive exceptionalization (Hecht 2012) of nuclear things. In this way, nuclear weapons waste is both worth studying for its own unique characteristics and understanding for its place as the most heightened and extreme example of the more general politics of “dirt.”

### Nuclear Weapons Waste in the United States and at WIPP

Investigating WIPP reveals the multi-scalar nature of waste and wasting within a nuclear weapons complex. The Manhattan Project and the Cold War created the need

for “the largest environmental cleanup program in the world” (DOE nd). Nuclear weapons environmental cleanup and waste management has more than one strand, but the DOE’s Office of EM is the main agency responsible for nuclear weapons waste and manages fifteen sites and approximately 84 percent of “the federal government’s \$613 billion estimated cost for its future environmental cleanup, known as ‘environmental liability’” (GAO 2022a). The scale and cost of this job are immense. The EM website claims that the area of the sites that DOE have cleared or are cleaning is equal to the combined area of Rhode Island and Delaware.

The \$613 billion estimated liability is a large amount of money, but is likely an underestimation given that the long history of undercounting costs and timescales for EM of weapons waste. These projects are both vast and vastly uncertain in scale and cost. For example, at the Hanford site in Washington State, where the majority of the US plutonium supplies were produced, there are 54 million gallons of radioactive waste residing in 177 underground tanks. Hanford by itself is “one of the largest and most expensive environmental cleanup projects in the world” (GAO 2023). In 2022, the DOE estimated the remaining cleanup costs at Hanford alone to be between \$300.2 and \$640.6 billion (DOE 2022). To give some context to these figures, the Congressional Budget Office projected the cost of the US nuclear forces from 2025 to 2034 would be \$946 billion (CBO 2025). This number will inevitably rise too, but what is clear from these projections is that simply cleaning up the legacy waste requires organization, time, and funding on a scale that is comparable to maintaining the US nuclear arsenal. What is also clear is that the funding for cleanup will not receive the projected needed amounts. DOE’s EM 2024 budget (\$8.28 billion requested per DOE 2024) is not rising in line with need. Indeed, one tactic of anti-nuclear weapons activists has been to work on making the possible trade-offs between spending on weapons and spending on cleanup a public and contested issue. As one interviewee put it, “I hope that this develops into budget competition between expanding nuclear weapons programmes and cleanup, because there is not the money for both” (Interview A3).

Nevertheless, nuclear waste is big business and one that also mirrors the rest of the nuclear complex in reliance on private contractors and subcontractors. In 2020, the office of EM was running thirty-two active “major contracts” worth over \$25 million with a combined value of over \$7.5 billion (GAO 2022b). Contractors outnumber federal employees across the nuclear waste landscape. The DOE’s NNSA Congressional Budget Justification 2024 gives an idea of the ratio of federal to contractor employment in the sector overall. The document states that “NNSA’s Management and Operating (M&Os) partners [contractors] employ approximately 57,000 people across the enterprise” and requested budget for “2,006 federal full-time equivalents” (DOE 2024). Furthermore, the Government Accountability Office assessed that subcontracts were “liable to mismanagement and fraud” (GAO 2022b) and that the DOE did not “have enough staff or staff with the right skills to properly manage contracts” (GAO 2021). As Jasanoff and Kim argue, the state “represents itself as a responsible regulator of a potentially runaway technology that demands effective containment. At the same time, the state has largely delegated the task of development and promotion to the private sector” (2009, 121).

It is thus obvious at a macro level that the scale and cost of nuclear weapons waste is such that it should not be considered as simply a by-product of nuclear weapons but is an issue that needs far more attention in its own right. It is subject to the same dynamics as the rest of the complex in terms of its institutional embeddedness, complexity, and contractor-driven nature and as such needs to be incorporated into any analysis of the nuclear complex. An extensive, messy system of waste has become embedded into federal, agency, and local budgets that has supported and will continue to support a complex of private contractors and profit.

Moving to an examination of the site level further reveals the objectivity of nuclear waste as creating and maintaining sociopolitical dynamics. WIPP is the largest

single employer in Carlsbad.<sup>6</sup> According to the city officials who spoke with me, residents of Carlsbad are overwhelmingly in favor of WIPP. This is not only because of the number of jobs (currently 1,700 according to [Bowen et al. 2024](#)) but because of the secure and stable nature of these jobs in contrast to other industries such as oil and gas and potash that have seasonal and insecure work. For WIPP supporters, this is a quality of life issue in a town that has long been subject to extractive industries.

WIPP has a much more consistent schedule, you can get home to your kids game. I mean, there's rotational shifts. And so, I think one of the issues is the safety element, it's a much safer, so you hit a certain phase in your life, and you're like, I can't, you know, I need something that's a little more consistent and stable. (Interview CO1).

There is, therefore, little public dissent in Carlsbad from the official support of WIPP. According to research conducted by Murphy and Kuhn in the mid-2000s on the development of the WIPP facility, "dissenting voices were and still are discouraged" (2006, 194). Activists in the north of New Mexico spoke of anxious employees approaching them after the 2014 fire, concerned about health repercussions but unwilling to speak publicly because of the social cost of opposition. Yet after the 2014 fire, Carlsbad hosted a series of public events, which were initially well attended but then public interest petered out while support of WIPP remained. The lack of political contestation today ties to the employment offered by WIPP. As one interviewee stated: "I mean, there's the practical reality of people are going to be pro something when it's tied into their employment or their employment of their family or things like that. I have family that works at WIPP" (Interview CO1). In Carlsbad, there is some local activism on the health impacts of oil and gas, but these activists deliberately avoid the issue of WIPP as it is too difficult to broach while maintaining support for their broader environmental efforts. One resident expressed their feeling of frustration as what they saw as a lack of questioning of WIPP while recognizing that

I think a majority of the community kind of has their hands tied by the opportunities that are here, and by what they're able to do ... you know, what other jobs are open for them to take, like, WIPP, for instance, really good paying jobs, you know, in a, in a place where there's maybe not that great paying jobs (Interview CR2).

In this way, local positions on WIPP partly reflects a broader dynamic in New Mexico in which the socioeconomic implications of decades of imposed nuclearity are embedded into lives, communities, and spaces. One interviewee described the broader New Mexico context with the example of local reactions to a campaign for investigation of the toxic legacy of the Trinity Test:

our state is so heavily influenced by the, you know, the nuclear industrial complex, and the federal spending here for everything around defence, and nuclear weapons and nuclear everything. And so, people also thought, the hand that feeds you, you absolutely don't do that. And people came to the [campaigner organised] meetings and said things to us, like, you're not going to be satisfied until they close the White Sands Missile Range and Holloman Air Force Base, and we have no jobs (Interview A6).

Studying the political and economic drivers of WIPP thus reveals complex socioeconomic dynamics of the nuclear weapons complex in New Mexico and across the United States.

<sup>6</sup>It is not the biggest employer by sector, but the single biggest individual employer.

### “A Bridge to the Future”

WIPP requires what Ialenti calls “a distinct politics of time” (2022, 388). This involves multiple overlapping timescales that combine technical assessments and assumptions that span millennia, such as the radiological half-life of Plutonium-239 (24,100 years), with electoral and regulatory cycles. For example, the New Mexico state permit for WIPP is approved every 5 years while DOE budgets require yearly approval and the Governor of New Mexico (who many interviewees stated was the key state political actor) has a 4-year term. Political debates about the timing of WIPP thus encompass and interconnect scales from deep time to the often short-termism of electoral politics (Ialenti 2021, 4–5) with political contests over meaning at each register. Examining the multiple scales and workings of time at WIPP show how the site is not one of nuclear endings and disposal, but of producing nuclear futures that maintain the narrative viability of the need for nuclear things.

Jessica Hurley develops a literary infrastructural approach that moves attention from nuclear violence as an imagined future nuclear apocalypse, and the hyper-visibility of the parts of the nuclear complex that maintain such understandings of nuclear threat, for example, in the mass reproduction of the image of the mushroom cloud (2020, 7). Instead, Hurley wants to present an alternative apocalypse, not as a universal end of time, but as a “radical afuturity” understood from below by those who have had “futurelessness” imposed upon them by “the racist, homophobic, and colonial chronopolitics of settler capitalism” (2020, 20). In so doing, Hurley configures the nuclear object as “continuous with a set of militarized infrastructures rather than their exceptional end point” (2020, 9), with infrastructure understood as “enviro-techno-social systems that keep disparate elements in mobile relation to each other” (2020, 11). Objects of infrastructure have a temporal dimension so that “[i]nfrastructure is thus produced by narrative forms, and at the same time it also establishes—at least partially—the kinds of narratives that can play out within its space” (2020, 13). Nuclear apocalypse as a possible future thus requires an ongoing production and maintenance of a vast global infrastructure that produces its possibility, alongside the enduring belief that maintaining such possibility is necessary.

The narrative infrastructural approach is helpful in conceiving of how WIPP is a creator of nuclear futures. While labeling WIPP as a site of nuclear disposal implies an ending and a finality, WIPP is actually a site of collision of different nuclear futures. Interviewees with opposing opinions on WIPP often considered the site in different time scales. For city officials, WIPP provides relief from the short-term cycles of boom and bust of the oil and gas industries by providing stable jobs for several decades. Waste streams from diluted plutonium and from new pit production will guarantee this stability:

So, once they get the dilute and dispose of the surplus plutonium done, then they'll start off with the production, that's gonna go to 2080. I'll be dead and buried. But this is what this is going to provide that facility, the long term viability, you've already got your book down to 2080, you know, you're gonna have work, those people are gonna have jobs, their kids can have jobs, whoever, you know, that's, that's, you can't get any more of a stable baseline than that for an economy (Interview CO1)

Those who oppose the new waste streams coming to WIPP through the dilute and dispose program and new pit production waste see this as short-term thinking and instead highlight longer-term concerns about containment and the possibility of accident with new types of waste streams, but also about what WIPP might become.

And also, as one of one of the technical people that worked on WIPP for a long time started saying was, you know, they're trying to make a plutonium mine of WIPP? Well, you know, who knows? 50 years, 100 years, 1000 years? If we're still around and people want to know where to get plutonium, why shouldn't you mine plutonium from the

WIPP site, if you've got that kind of pure plutonium? Rather than going through the whole process of, you know, enriching and creating plutonium that way? You know, we've created the world's only plutonium 239 mine. (Interview A1)

The politics of timing here is also an issue of consent. Activists campaign against what they term “Forever WIPP” and cite the fact that WIPP's originally assumed (though not mandated) closing date was 2024, yet it is now planned for 2083. While the time extension is not against the letter of the legislation, the suggested original date propagated what a New Mexico state official described as

a social contract between the permittees and the state of Mexico that this is how long they were going to operate. And that's what a lot of people felt would be the case, that it would be closing in the next year (Interview NMO1).

A feeling of the breach of this “social contract”—also described in the NAS report (2022)—is exacerbated by the changing nature of the waste to be disposed in WIPP from legacy waste to including new pit production waste. These changes also happen in the broader history of Manhattan Project and DOE contamination of New Mexico land and decades of obfuscation about the nature and extent of this contamination. The timing of WIPP's mission is therefore a fraught question that includes issues beyond technical calculation. But, as the next section will show, the technical calculations in themselves are also deeply political.

#### Determining Timelines

Throughout the 1980s and 1990s, the EPA developed a set of regulations that worked alongside state requirements to set standards for WIPP waste disposal. One of the jobs of such regulation is to set timescales. For how long will the proposed waste management and disposal systems promise safe containment? At WIPP, there is a 10,000-year individual exposure requirement in that the legislation obliges that any disposal system limits the amount of radiation that an individual can be exposed to (for example, through drinking water) for the next 10,000 years. Yet that was not the original timescale. The EPA firstly determined that 1,000 years was appropriate. In 1987, however, a First District Court determined that the agency's figure was “largely unsupported and, therefore, arbitrary” (EPA 1993) and required amendment. The EPA moved to 10,000 years giving a variety of reasons beginning with the fact that

Wastes emplaced into disposal systems will remain radioactive for many thousands of years. Therefore, the Agency believes significant public health and environmental benefits can be gained by selecting a longer time frame for the requirements (EPA 1993).

That this basic fact about the radioactivity of the waste was clearly the case before the court decision makes it a strange justification for changing from 1,000 to 10,000 years. This example provides an indication of how projecting this far into the future carries a level of arbitrariness that can be obscured but not overcome by complex modeling and forecasting.

Michael Peterson (2023) points out that in order to determine such containment limits further assumptions must be made. In the Federal Code Section 194, the EPA admits the impossibility of predicting “the future state of society, sciences, languages or other characteristics of mankind” and therefore assumes that “population density and land ownership patterns in the Waste Isolation Pilot Plant's (WIPP's) surrounding regions are assumed to remain consistent with today's conditions for the next 10,000 years” (Peterson 2023, 2; also Hurley 2020). Peterson argues that this assumption, apart from being ungrounded, is important because waste facilities such as WIPP are sited at places of economic disadvantage that make residents more

likely to accept higher risk. WIPP has been “sited due to accrued advantages and disadvantages resulting from a capitalist fossil fuel economy and it is only by maintaining those accrued advantages and disadvantages that the stability necessary to predict the maintenance of the isolation of that waste can be achieved” (Peterson 2023, 8). In this way, the predictions of WIPP stability, and generally of nuclear waste sites, not only enable but require the reproduction of economic precarity.

These contests over timing and alternative futures illuminate WIPP as a site of production and reproduction. WIPP does not only reproduce social dynamics but also enables new forms of action by making Carlsbad and its surrounds a nuclear place with nuclear futures (Saraç-Lesavre 2020). In recent years, city leaders have repeatedly sought to further expand the area’s nuclear activities. There is an ongoing dispute about the proposed siting of a storage facility for spent fuel and high-level waste in Lea County between the cities of Carlsbad and Hobbs. The plan is a partnership between the company Holtec and the Eddy Lea Energy Alliance, which is made up of Eddy and Lea counties, Carlsbad and Hobbs. The DOE has also identified 9,000 acres of land at WIPP that could be used as part of its “Cleanup to Clean Energy” Initiative for land for what “carbon-pollution-free” energy projects. City leaders have focused on the possibility of developing nuclear power on site through WIPP expertise.

It really helps our you know, attract other, other nuclear projects, you know, the Department of Energy just announced a couple of weeks ago, this programme called Cleanup to Clean Energy. And we got selected as a WIPP site ...And it was an interesting meeting with them because we sort of ... solar power were fine, but we should also look at small modular reactors. You know, and so that was, that was the headline on the newspaper today, it was that we, we advocated for small modular reactors on the on the WIPP site (Interview CO1).

You’ve got nuclear scientists already there. You’ve got the land has been characterised for nuclear use and activity; they’re getting land for free (Interview CO2).

Residents of Carlsbad outside of the official processes also identified the power of WIPP to shape Carlsbad as a nuclear place.

But WIPP itself is an example of this kind of creeping momentum that that just keeps coming at you. ... So once that took place, and we got in place this facility at WIPP, we became a community where nuclear things were understood, we had well trained people in the community. You know, we, we, we kind of felt like, the community kind of felt like, well, we can handle this, we know how to do this kind of thing (Interview CR1).

Those who oppose WIPP expansion see the long-term implications of the nuclearity it imposes on southeastern New Mexico as troubling and dangerous. Yet the perceived permanence of WIPP for many in Carlsbad provides reassurance about an uncertain future.

But like our city governments, and people here, definitely see it as a bridge, you know, to the future or something that, like we can always lean on and count on (Interview CR2).

WIPP thus shapes the future imaginaries of both supporters and opponents. It opens up and requires narratives about the future across differing timescales, and it is through these narratives that the meanings of nuclearity at WIPP and beyond are contested.

### WIPP as a Technopolitical Project

WIPP also provides insight into nuclear weapons politics in how the important questions of time and scale it provokes are rendered unseen by technopolitics, becoming what Hurley labels as a “domain of imperceptibility” (2020, 8). Hecht examines the nuclear as a technopolitical realm, defining technopolitics as the “strategic practice of designing or using technology to constitute, embody, or enact politics goals” (Hecht 2009, 56).<sup>7</sup> Technopolitics are alluring because they displace power onto technology, but this can have unintended consequences in which the technological things subsequently mold and escape the limits of this imbued power. Technopolitical strategies can thus “camouflage the political dimensions of contentious issues, dissolving them into arcane technical matters that only a few experts seem qualified to adjudicate” (Hecht 2023, 5). Hecht combines technopolitics with an understanding of nuclearity as having a variable status in time and space determined by sociopolitical conditions as well as scientific ones. In doing so, Hecht exposes the hierarchies and injustices created and perpetrated through the condition of nuclearity. This includes, for example, racialized class hierarchies in South Africa reproduced through the “residual governance” of mining waste of both uranium and gold (2023). Hecht’s residual governance identifies universal themes of waste management, including “simplification, ignorance and delay” and treating “people and places as waste and wastelands” (2023, 6).

WIPP can be understood as a technopolitical project in that it provides a technical solution to the problem of nuclear waste, in turn reproducing the problem itself as technological. This is not to deny the importance of technology, or impose a binary with politics on one side and technology on the other. Rather, it is that political and moral questions of nuclear waste (Von Schnitzler 2014) have been re-framed into specialist issues such as TRUPACT containers, ventilation systems, or whether WIPP calculates waste volume per outside or inside of a container. These are not unimportant topics, but they also can lead debate in endless loops of detail, inaccessible to those who have not spent months or years learning their minutiae. As such, WIPP debates provide an example of technopolitical dynamics in which “technical knowledge can be mobilized to undermine lay agency, under-cut community dissent, or perpetuate structural violence” (Ialenti 2022, 388). This differs somewhat from the margins of nuclearity characterized by Hecht as residual governance. Hecht identifies “simplification, ignorance and delay” (2023) as governance tactics in these spaces, but at WIPP, governance is less about simplification than complication, includes ignorance but in a context of an abundance of information, and manifests interconnected timelines of both delay and acceleration.

I encountered these dynamics myself while conducting this research. Studying nuclear waste and the specifics of WIPP was a steep learning curve involving reading hundreds of pages of government reports, budgets, state permit debates, and many other texts. Reading these texts required cross-references to even more reports and looking up scientific and engineering terms. I learned as much as I could as a non-scientist or engineer. There was no lack of information should you have the time and ability to find and read it. Indeed, I felt the amount of information overwhelming. That such information is publicly available is a result of changes in the 1990s when the DOE began an “openness initiative” in response to heightened public awareness of environmental contamination at DOE sites. The initiative included “declassifying documents, expanding opportunities for public involvement, competitively rebidding contracts, increasing protections for whistleblowers, and publicly apologizing to victims for harms” (Taylor et al. 2005, 375). WIPP’s recent NMED permit also has embedded public outreach through the requirement for a Community Relations Plan that will “keep communities and interested members of

<sup>7</sup>For a useful overview of literature on technopolitics and security, see Müller and Richmond (2023).

the general public, including interested members of New Mexico’s nations, tribes, and pueblos” informed about WIPP permit activities (NMED 2024, Section 1.15.1). WIPP public outreach also has included engaging with schools through events like science fairs in Carlsbad (Interview FLE1). One interviewee remembered WIPP trucks coming to their school. Carlsbad officials are proud of WIPP and offer tours to interested visitors:

there’s no negative connotation with WIPP, we’re happy to show it off. When visitors come to town, we try to set appointments up. So, they go down into the mine and actually see what we do, how we handle the waste, where it’s stored, why it’s a better idea, storing it here than on top of the ground (Interview CO2).

Such openness has resulted in greater participation in some DOE processes. At WIPP, activists who oppose expansion have become extremely well versed in technical issues and using expertise to contest WIPP, for example, succeeding in inserting clauses on issues such as enhanced DOE reporting into the most recent WIPP permit renewal document. There is a committed core of actors who organize petitions and give informed and extensive feedback to any open call. This openness, however, is all conducted in a specific and limited form and language that perpetrates exclusions in what Arnhold has described as “a new form of opacity” (2023, 2150). There are two forms of exclusion at work here. One is a practical one of access to the information about WIPP and nuclear waste activities. Activists raised the issue of access to information for those without internet and low English proficiency, mainly Spanish speakers.<sup>8</sup> The second is perhaps more pervasive in that even those who can access the information and attend meetings can only do so through the language of scientific expertise. After my study of WIPP, I still struggled to follow the discussions at public events in a way that would allow me to formulate a meaningful question. The meetings are also often incredibly dull, with presentations of technical issues containing graphs and maps that are impossible for the layperson to decipher. As such, the information is technically available and the meeting is open, but debate is not possible in any form but that of technical details. These are important issues but, nevertheless, the experience of a public forum for anyone but the most dedicated attendee is one of stultifying boredom.

Arnhold refers to this situation as “public containment,” the “existence of public information and narratives, but which do not reflect the stakes, conflicts, and problems faced by public actors” (2023, 2150; Hilgartner 2007). One Carlsbad resident reflected on the impact of this “public containment” on their ability to engage in these issues:

I will say something that I’ve always just kind of noticed, growing up here, really, because what has always been a huge presence, is, if you question anything, you’re made to feel kind of not intelligent enough to be questioning it ...

because there is such a culture of, oh, it’s all taken care of. You don’t need to worry about it. It’s above your head, and you’re safe. And so yeah, I’m not sure that everyone kind of realises the agency they have, or you know, that these agencies aren’t perfect (Interview CR2).

The social and epistemic status of scientists and experts reinforces the implications of the opacity of information according to one activist:

from a citizen standpoint, the, the reason this is important, and I use it with, you know, public education and advocacy is the average citizen, gets easily flummoxed by the great scientists with Los Alamos and Sandia and WIPP saying this was all perfectly

<sup>8</sup>According to Census.gov, 18.3 percent of NM households do not have a broadband internet connection and according to a NMED 2024 study “The number of Limited English-Speaking Households in New Mexico total 42,420 with 79 percent (34,317) of those households reported to speak Spanish” [https://cloud.env.nm.gov/resources/\\_translator.php/ZjU4ZmJhZDBhZWZlbnU3NDg3MzA1NDhhNF8xNTk1NDk~.pdf](https://cloud.env.nm.gov/resources/_translator.php/ZjU4ZmJhZDBhZWZlbnU3NDg3MzA1NDhhNF8xNTk1NDk~.pdf).

safe, and it's hard for you to understand all the difficulties of geology and hydrology on the one hand, and health physics and radiation on the other hand (Interview A1).

These exclusions, combined with the social and economic pressures, make it difficult to have a meaningful discussion about WIPP and understand its implications in a holistic way. One Carlsbad resident put it this way in speaking of debates about a possible accident at WIPP:

I think that one of one of the things here that was a focus of protest was the danger of a spill of nuclear waste. Well, I don't really think that's a very great danger, because, and I think that's what I would call a rabbit trail that they want you to run down, the greater problem is that we are creating a toxic byproduct that cannot have contact with human life. And we, if we are able to find a place to put that, we will continue to do that, we will continue to create more and more of that waste, and there is no end in sight. (Interview CR1).

Having a conversation about WIPP in the contained terms of technopolitics elides questions about the ethics and impacts of continuing nuclear waste production.

### Conclusion

This article has argued that those of us who study the international politics of nuclear weapons need to engage further with the productive political power of nuclear waste and waste disposal. Waste matters and not just as a by-product to be managed and disposed of, but as an active and crucial part of nuclear weapons complexes that creates political, economic, and social structures. The article has shown the extent of the nuclear weapons waste complex at a macro level and its dynamics of shaping nuclear possibilities at local, state, and national levels. Waste in general creates economies and communities, and nuclear waste specifically has additional impacts stemming from both its extreme nature and the ontological separateness of the nuclear established through discourses of exceptionalism (Hecht 2014). The article has further argued that international nuclear politics needs to expand to include the study of waste and waste sites as productive parts of a system of mass destruction.

Studying WIPP demonstrates the relationship between waste's objectivity as a core part of the nuclear weapons complex, how the infrastructures of waste establish and are established themselves through nuclear narratives and how the depoliticizing technopolitics of nuclear waste governance obscure waste as a "domain of imperceptibility" (Hurley 2020, 8). The significance of bringing waste studies and infrastructure to the fore in IR studies of nuclear weapons is to firstly show the place of WIPP in the US nuclear weapons complex, but also to illuminate how waste sites produce nuclear politics and nuclear futures in ways that have been overlooked in international studies of nuclear weapons. What is particularly interesting about WIPP is how, unlike other controversial sites of environmental cleanup such as Hanford, or other sites in New Mexico such as the area around Los Alamos, WIPP is understood as a place of management and disposal at the end of the nuclear fuel chain. It is portrayed as an outcome of nuclear politics and not a site of political contestation at a national or international level—its contests are mainly local or statewide. Officials portray WIPP as a success story, and a largely settled matter apart from objections of the "antis." Yet this article has shown that WIPP actually reveals crucial themes, tensions, and ambiguities in the politics of nuclearity. Understanding WIPP also helps illustrate questions about who gets to participate in the choices about nuclear harms and on what temporal and spatial scales such discussions should be based (Murphy and Kuhn 2006).

Finally, there are practical policy reasons for foregrounding the significance of nuclear weapons waste. Firstly, there is a clear ethical imperative for those advocating the maintenance or buildup of nuclear weapons arsenals to account for the

impacts of waste to date and any further waste to come from their proposals. This is almost never done. There is also a need to meaningfully incorporate nuclear waste in any work that aims to understand the impacts of nuclear weapons and the potential for nuclear disarmament. William Walker recently articulated a need for further research on “nuclear embeddedness,” arguing that “nuclear disarmament and significant steps in its direction must always involve, beyond the traditional effort in persuasion, negotiation and regulation, an exercise in disembedding an enterprise and set of beliefs, attitudes and ideas that have deep and resilient foundations” (2020, 8). Similarly, recent work on developing disarmament verification in the TPNW has engaged with the “profound state transformation” and “unmaking of deeply entrenched and embedded national identity, policy, priorities, and political and institutional commitments and capabilities attached to nuclear weapons” (Phillippe and Mian 2022, 6). This paper argues that the “disembedding” and “unmaking” these researchers identify should engage with the political import of sites of nuclear weapons waste clean-up, management and disposal as not just an outcome of weapons production but as playing a core part in the shaping and embedding of nuclear weapons.

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### Interviewees Quoted in Text

- A1—Activist 1.
- A3—Activist 3.
- A6—Activist 6.
- CO1—Carlsbad Official 1.
- CO2—Carlsbad Official 2.
- CR1—Carlsbad Resident 1.
- CR2—Carlsbad Resident 2.
- FLE1—Former Lab Employee 1.
- NMO1—New Mexico Official 1.