https://doi.org/10.5194/sand-2025-7
Preprint. Discussion started: 22 January 2026

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Living with the nuclear:
Spatio-temporal entanglements, nuclear cultures, and the afterlives of uranium mining

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Abstract: This paper examines how uranium mining in East Germany – embedded in the geopolitical dynamics of the Cold War – produced specific nuclear cultures that continue to shape the present. Drawing on the spatio-temporal entanglements of extraction and post-extractive remediation, the article demonstrates that the 'nuclear' is not solely technological but deeply rooted in everyday life-worlds, social relations, and cultural practices. By analysing ambivalences – between exceptionalism and banalisation, risk and privilege, destruction and infrastructure, secrecy and everyday life, as well as trauma and nostalgia – it becomes evident how uranium mining shaped identity, memory, and regional belonging. Particular attention is paid to the role of knowledge archives, nuclear cultural heritage, and global circulations of expertise, as well as the challenges posed by long-term radioactive temporalities. In doing so, the paper contributes to understanding how the nuclear becomes effective in everyday life, and how its material and immaterial afterlives can be remembered, communicated, and responsibly shaped across generations.

From Cold War extraction to post-mining remediation, this paper examines how uranium mining in East Germany – locally embedded in global power structures – shaped everyday life, regional identity and long-term futures. It traces how people live with ambivalences and radioactive afterlives, and how knowledge, memory and nuclear heritage circulate across generations. By revealing spatio-temporal entanglements, it demonstrates why nuclear legacies demand justice, responsibility, future visions.

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1 Introduction

The termination of key bilateral agreements between the United States and Russia, the absence of strategic dialogue, and the intensification of nuclear signalling point to a qualitative deterioration of the
60 security environment. At the same time, the non-proliferation regime has long exhibited structural dysfunctions, exacerbated by the nuclear ambitions of individual states and a renewed geopolitical polarisation. According to the current *NTI Nuclear Security Index*, seven of the nine nuclear-armed states – France, India, Israel, North Korea, Pakistan, Russia and the United Kingdom – as well as Iran have expanded their stocks of weapons-grade fissile material over the past three years (NTI, 2025). In
65 addition, all nuclear-armed states continued to modernise their arsenals in 2024; by early 2025, of an estimated global total of 12,241 warheads, around 9,614 were in military stockpiles and thus potentially operational (Kristensen and Korda, 2025). Taken together, these developments mark a re-emergence of Cold War logics – albeit within a fundamentally altered nuclear age – accompanied by rising tensions and uncertainty across the global nuclear order.

70 At the core of these security dynamics lies a shared origin: uranium mining. Any future nuclear arms race will likewise depend on uranium. Historically and today, uranium has been central to nuclear weapons, nuclear threat politics and the climate crisis. As the foundational material of nuclear energy – whether for civilian or military purposes – uranium mining constitutes a crucial link in the nuclear chain (Hecht, 2012: 23; 2014) and is thus central to international security. Yet the origins of this material
75 remain largely invisible in political and security discourses. Dominant narratives focus on reactors, missiles and geopolitical power projection, while the places where uranium has been extracted, processed or left behind receive little attention (Hecht, 2012; Biswas, 2014; 2023). This blind spot has a structural dimension: nuclear cultures simultaneously generate memory and forgetting, visibility and silence – they function, in Foucauldian terms, as co-producing orders of remembrance and erasure
80 (Foucault, 1969). This paper challenges this ahistorical perspective by foregrounding the everyday experiences of those affected by uranium mining at the local level. It asks: Where does uranium actually come from, and how are its legacies governed – particularly within the intertwined contexts of justice and security? Moreover: How do nuclear cultures manifest in these processes? How are they shaped through spatial and temporal configurations? And what role do archives of memory and knowledge
85 play?

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The focus of this article is therefore not the global arena of grand strategic manoeuvres, but rather the glocal interplay – and particularly the local and the everyday – as key sites of the nuclear. As Eschle (2018) argues, turning towards the everyday makes international politics visible where it is embodied and lived – "in the banal, routine activities and practices" (Eschle, 2018: 290). Uranium mining is one such juncture: an everyday, labour-based practice deeply embedded in global power politics, colonial continuities and long-term radioactive temporalities. The article also builds on Hecht's work on *nuclearity* (2012; 2014), which demonstrates that the nuclear is not an ontological given but is produced through political, technological and bureaucratic demarcations – rendering certain materials, practices and spaces 'nuclear' and therefore exceptional, while others are classified as 'non-nuclear', normalised and thereby rendered socially and politically invisible.

This is exemplified by uranium extraction in East Germany under Wismut. Between 1946 and 1990, uranium was mined by Wismut in Thuringia and Saxony for the former Soviet – now Russian – nuclear weapons programme (Schütterle, 2010; Wismut GmbH, 2010). During the Cold War, Wismut ranked among the four largest uranium producers in the world (IAEA, 2018), leaving a lasting imprint on the region and shaping its identity. Under strict secrecy, uranium mining, military interests and political control profoundly transformed the Ore Mountains and eastern Thuringia – socially, medically, ecologically and culturally (Fengler et al., 2014; Schütterle, 2010). The inherent ambivalences of nuclear labour – 1) exceptionalism and banalisation, 2) risks and privileges, 3) destruction and infrastructure, 4) secrecy and everyday life, and 5) trauma and nostalgia – produced specific nuclear cultures that continue to shape the region today.

These aftereffects, or 'nuclear afterlives', are temporally and spatially entangled. Radioactive legacies, social traumas and transformed landscapes persist across generations as 'spacetimemattering' (Barad, 2017), connecting past, present and future in material as well as symbolic orders (Schwab, 2023; Voyles, 2015). Because memory, identity and knowledge are structured by relations of power, many experiences of uranium mining remain – as Lutz (2001: 1) shows for military worlds – part of an "invisible world", obscured by state secrecy, political instrumentalisation and dominant narratives of progress.

This paper takes these dynamics as its point of departure. It examines how the spatio-temporal entanglements of uranium extraction in East Germany have produced specific forms of nuclear culture, how local experiences are interwoven with global orders of deterrence, security and energy politics, and what role knowledge, memory and cultural heritage play in shaping present and future forms of nuclear governance. The analysis draws on scholarship on nuclear cultures, memory studies, heritage studies and the ethics of responsibility.

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The research draws on a review of the Wismut company archive and files from the Federal Stasi Archive, which were crucial for contextualising the political, institutional and material conditions of uranium extraction and remediation. Fieldwork included participation in meetings of local heritage and miners' associations, enabling insights into community dynamics, memory practices and regionally embedded forms of expertise. As a researcher shaped by a 'West German socialisation', I critically reflect on my own positionality, biases, and the need to learn the region's historical, cultural, and emotional landscapes to approach the topic with appropriate sensitivity. Conversations with former workers, residents and local actors – conducted both individually and in small groups – were documented through memory protocols rather than audio recordings to create safe, open and non-intrusive spaces. Carefully selected excerpts from these conversations are interwoven throughout the text to foreground lived experience and to acknowledge the collaborative nature of knowledge production. Through the combination of ethnographic interviews, archival materials and political-historical analysis, this article pursues a bricolage-based epistemological approach: bringing together diverse forms of knowledge to illuminate the invisibilities, ambivalences and continuities of the nuclear – and thereby to reframe questions of nuclear justice, responsibility and futurity.

2 Spatio-temporal entanglements of uranium mining

The development and deployment of the first atomic bomb precipitated a fundamental shift in the human understanding of temporality. With knowledge of a potentially planet-destroying force, a "rupture in the temporal order" emerged (Schwab, 2023: 41), which profoundly unsettled the experiential modes of the past, present, and future. Since that moment, humans have lived within a doubled, overlapping temporality: a fear of nuclear futures and an unending presence of nuclear pasts (Schwab 2023). This shift forms the epistemic backdrop against which nuclear cultures in politics, everyday life, and spatial planning have emerged. As Stürmer (2023) shows, nuclear temporalities are frequently divided into two opposing poles: they either appear as the apocalyptic future of an inevitable nuclear event or as a closed-off relic of the Cold War. Both readings, however, obscure the "unending present of nuclear violence" (ibid.: 7), in which radioactive materials, military infrastructures, and toxic residues exert lasting effects and shape time as a continuously interwoven configuration. This entanglement of materiality, violence, and temporality can only be grasped if nuclear phenomena are not viewed in isolation. Barad (2017) points to the entwinement of nuclear violence with colonial power relations, racial capitalism, militarism, sexism, and climate-related injustices. Building on this, Hurley (2020) similarly argues that nuclear violence is not merely a technological or military problem, but is enmeshed with broader power structures and permeates intimate, social, and cultural spheres of life. The

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everyday experience of radioactive contamination, the uncertainty surrounding invisible hazards, or the transmission of illness and social disadvantage across generations demonstrate that nuclear cultures are not defined solely by a single catastrophic event, but by the continuous interplay of substances, emotions, and institutions of historical injustice.

Against this background, uranium mining appears as a paradigmatic form of what Nixon (2011) has termed ‘slow violence’: a creeping, often invisible form of violence that unfolds over long periods of time and whose destructive effects are socially unevenly distributed. Bickerstaff (2021: 956) describes this form of violence as “temporally dispersed” – it operates with delay, often eludes political recognition, and is frequently normalised as an unavoidable component of industrial development. Slow violence does not constitute a passively accepted reality, but is produced and stabilised by political and economic structures that marginalise local forms of knowledge and intensify geographical vulnerability (Bickerstaff, 2021; Mah and Wang, 2019). Uranium mining follows specific temporal rhythms: the logic of ‘boom and bust’ generates rapid industrial expansion, while certain health-related, social, and ecological harms become visible only decades later (Voyles, 2015). When radioactive exposure leads to illness, those who bore responsibility are often no longer present – the temporality of consequences detaches itself from the temporality of decisions. In this way, uranium mining produces not only geological but also political temporal displacements.

From a spatial perspective, it becomes evident that uranium extraction integrates places, landscapes, and social spaces into the infrastructures of military value chains. Extractive zones do not emerge by chance, but along existing power relations, global demand, geopolitical strategies, and local vulnerabilities. At this point, the question ‘where does uranium actually come from?’ becomes central, not only as a geographical inquiry but also as a question of relational spaces, economic dependencies, and material transformation.

Historically, uranium mining has been closely intertwined with (neo)colonial patterns and oppressive power structures of resource extraction (Hecht, 2014; Nichols, 2025; Voyles, 2015). The systematic exploitation of marginalised or Indigenous populations and their territories for uranium mining, nuclear weapons production, and nuclear waste disposal is referred to as ‘nuclear colonialism’ (Churchill and LaDuke, 1986; Runyan, 2022). The term describes those power relations in which Indigenous and other historically disadvantaged communities – for example, in North America, Africa, Australia, or Central Asia – bear the ecological and health-related burdens of the nuclear production system. It is estimated that at least two-thirds of the uranium supply of Canada and the USA originates from Indigenous land (Runyan, 2022). Particularly in former colonial territories on the African continent, people are still being exploited for the extraction of uranium under asymmetrical power structures and critical working conditions, for example, in Arlit, Niger or Rössing, Namibia. This not only results in enduring

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environmental destruction but also in substantial health problems for affected communities (Winde et al., 2017). Closely linked to 'resource colonialism', nuclear colonialism highlights how the control over land and material resources simultaneously serves to maintain geopolitical power relations and technological dominance (Runyan, 2022).

Samia Henni (2025: 35) follows this line of argument and demonstrates, with the concept of colonial toxicity, how nuclear projects hierarchise both spatiality and temporality. The spatial dimension illustrates how colonialism and nuclear modernity not only extract raw materials but also organise and control entire territories, places, and social spaces in hierarchical ways (ibid.). Certain regions and infrastructures – such as uranium mines or exclusion zones – become zones of toxic exposure and, at the same time, instruments of geopolitical and economic power, while the perspectives and rights of those locally affected are marginalised. The devaluation of persons and communities considered 'subaltern', 'subhuman', or not 'civilised' serves to justify the use of particular spaces for nuclear testing or uranium extraction, thereby reproducing who bears the costs of nuclear violence under the guise of securitisation (Biswas, 2021: 150; Choi and Eschle, 2022: 1133-34). Formerly colonised or Indigenous areas are often declared 'empty' in order to legitimise their exploitation – even though, as Henni (2025: 39) emphasises, they are inhabited "by human and nonhuman lives". These colonial narratives stabilise existing power relations by shaping perceptions, practices, and lived experiences and thus reproducing ongoing forms of structural violence and control over marginalised groups (Nichols, 2025). With Voyles' (2015) concept of 'wastelanding', particular spaces and bodies are marked as "pollutable" (ibid.: 9), constructed on the basis of racist attributions and power relations. Voyles argues that 'non-white spaces' are frequently constructed as worthless – or merely as reservoirs for extractable resources. Their devaluation is followed by their systematic destruction through environmentally harmful industries. As "sacrificial lands" (ibid.: 10), these exploited territories enable the continued growth and profit or security logics of nuclear modernity.

At the same time, colonial toxicity signifies that colonialism does not merely colonise spaces but also times – a colonialisation of temporalities. Nuclear modernity determines whose time counts: it privileges the short-term interests of geopolitical and economic profit maximisation, while the slow temporality of environmental destruction, disease, and intergenerational harm is rendered invisible. In this process, pasts that emphasise technological progress and nuclear power/violence are foregrounded, while local or Indigenous conceptions of time are marginalised, and futures encompassing long-term risks to humans and the environment are systematically displaced (Barad, 2017; Schwab, 2023). Colonial notions of land, therefore, extend beyond territorial control: land is inscribed with particular visions of the future – as space for development, extraction, or security in line with colonial interests

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(Nichols, 2025). Colonialism thus continues to shape definitions of which land uses are deemed legitimate and whose futures are enabled or excluded.

The (neo)colonial structures continue to shape the uranium trade to this day. Extractive projects penetrate deeply into political orders, generate new boundaries, create infrastructures, and reorganise everyday rhythms of life. They are simultaneously products and producers of spatial inequality. It is scarcely possible to discuss uranium mining and the global trajectories of uranium without invoking the concept of nuclear colonialism. The term reveals the intimate entanglement of extractive, political, and epistemic power structures, as well as how racist justificatory narratives and colonial logics of appropriation, dispossession, and environmental destruction are perpetuated within the nuclear-industrial complex (Churchill and LaDuke, 1986; Runyan, 2022).

For East German uranium mining, however, this concept cannot be applied directly. Although profound asymmetrical power relations existed here as well – particularly through the authority of the Soviet occupation forces and the GDR over living spaces, resources, labour, and knowledge – this relationship was not grounded in colonial or racialised hierarchies. Rather, within the context of Wismut, an oppressive, state-socialist system of control manifested, instrumentalising population and landscape for geopolitical and military objectives and subordinating them to a strict functional logic: securing strategic raw materials for the Soviet nuclear complex. Parallels in the structures of extractive control and environmental impact can be made visible here without appropriating the specifically colonial dimensions of other contexts. East German uranium mining can thus be read as part of a global history of extraction and dependency, whose traces in landscape, society, and memory persist to this day.

The persistence of radioactive materials across timeframes that far exceed human imagination highlights the particular temporality of nuclear cultures. Radioactive substances operate over generations, displacing the temporality of social and political responsibilities and embedding human bodies within enduring material processes (Nichols, 2025). Barad (2017) emphasises that nuclear events and their consequences unfold on scales that are scarcely perceptible to the senses, while simultaneously shaping political decisions and cultural conceptions of the future. The question of knowledge and responsibility management – for instance, in addressing historical mining legacies and nuclear waste – thereby becomes both a temporal and epistemic challenge.

Radioactivity "resynchronises and reconfigures temporalities/spacetimematterings" (ibid.: 63) by reorganising the relationships between bodies, materials, landscapes, and institutions. 'Spacetimemattering' describes this inseparable entanglement of space, time, and matter: they do not exist independently of one another but are co-productions of social, material, and discursive processes (Barad, 2017). In the context of nuclear cultures, this means that radioactive substances transform

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landscapes, restructure social relations, and modulate political temporalities – such as responsibility, memory, or forgetting. Uranium mining is therefore not a closed historical event, but an ongoing process in which past, present, and future remain intertwined.

Haraway's (1988) concept of 'situated knowledge' complements this perspective by emphasising that such space-time-materialisations are always produced through concrete epistemic practices. Uranium mining thus constitutes a node of situated knowledge – "webs of knowledge and power" (ibid.: 588) – in which labour practices, routines, geological expertise, and techniques not only generate knowledge about uranium but also shape spatial orders, temporal rhythms, and material realities. This approach highlights that uranium mining does not simply occur in space and time; it produces space and time themselves – through infrastructures, labour regimes, and narratives of progress, security, and contamination. The temporalities of extraction and remediation unfold across multiple scales: from the geological deep time of uranium formation to the political temporalities of the Cold War and the deferred futures of ecological restoration. Likewise, the spatialities of uranium mining are not confined to the mine itself but extend across transnational networks of expertise, secrecy, and waste circulation.

The following sections concretise these theoretical considerations using the example of uranium mining in East Germany. The Wismut mining operations represent a particularly dense node of spatio-temporal entanglements: they emerged from geopolitical ambitions, reorganised work and living environments, and left a material and temporal legacy that continues to resonate today. Section 3.1 traces the emergence and operation of uranium mining under socialist industrial and power structures and demonstrates how extraction produced specific spatial orders and political temporalities. Section 3.2 focuses on the post-extraction phase and examines the transformation from 'uranium supplier' to 'environmental remediator'. Remediation practices are understood as processes that generate new temporalities – of expectation, responsibility, memory, nostalgia – and reconfigure spatial orders. Through this dual perspective, the chapter illustrates how uranium mining produces shifting relationships between space and time, and how these relationships persist, transform, or dissolve in the long aftermath of extraction. This analysis simultaneously provides the foundation for investigating, in subsequent sections, the role of nuclear culture in negotiating these spatio-temporal orders.

2.1 Uranium mining in East Germany

The experiences of the First and Second World Wars prompted the great powers to pursue what was regarded as the "ultimate weapon" (Karlsch and Zeman, 2008: 5), aiming both to prevent a recurrence of widespread devastation and to secure their dominant position in the emerging global order (Hecht, 2012; Nichols, 2025). In this context, the Manhattan Project – encompassing extensive uranium mining,

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the development and testing of nuclear weapons, and culminating in the bombing of Hiroshima and Nagasaki – ushered in a new era: the nuclear arms race. For the Soviet Union, which had previously shown only limited engagement in nuclear armament, this development rapidly became a strategic priority, driven by the need to counterbalance the US nuclear monopoly (Karlsch and Zeman, 2008; Vieluf et al., 2026). The US nuclear weapons program was perceived by the Soviet Union as an existential threat, compelling an urgent need for nuclear arms – all "under the banner of *nuclear deterrence*" (Futter, 2021: 91, emphasis in original).

In the 1940s, Soviet spies played a pivotal role in the rapid advancement of their nuclear arsenal (Futter, 2021; Vieluf et al. 2026). To produce nuclear weapons, the Soviet Union needed as much uranium as possible as quickly as possible, resorting to all available means to bridge the uranium gap (Schütterle, 2010). The focus was solely on the military use of uranium for their nuclear weapons programme (Fengler et al. 2014). In the summer of 1945, military expeditions were swiftly launched to survey uranium ore deposits. Initial discoveries on the Czechoslovak side of the Ore Mountains prompted immediate extraction, primarily carried out by political prisoners (Schütterle, 2010; Vieluf et al., 2026). Upon the discovery of uranium reservoirs in East Germany, extensive efforts were undertaken to expedite uranium production, impacting all sectors of the economy. Seven Saxon ore mines were requisitioned by the Soviet military as reparations. In 1949, SAG Wismut was founded and headquartered in Moscow with a branch in Aue (Fengler et al., 2014).

Wismut was essential to the Soviet nuclear complex (Karlsch and Zeman, 2008). Mining operations in East Germany narrowed the uranium gap with the United States, sustaining Soviet competitiveness in the nuclear arms race (cf. Fengler et al., 2014). Notably, this occurred despite the initial US occupation of Saxony and Thuringia. The Soviet Union only gained possession of its clandestine uranium source, which wielded significant political influence throughout the Cold War, through a swap with the Western powers for West Berlin, as it was believed to confer greater strategic leverage to the United States (Schütterle, 2010).

Uranium mining in the Ore Mountains can be divided into four phases: 1) 1946-1954, 2) 1955- mid-1970s, 3) mid-1970s to 1990, and 4) post-1990, delineating the post-mining era. Following the closure of the mines, Wismut was transformed into Wismut GmbH, a company that remedied environmental damage and contaminated sites. The different historical phases were each characterised by unique challenges and developments. In this chapter, the focus is placed on the first three phases, corresponding to the period of active extraction, while the aftermath of the mining – including the transformations and remediation efforts – is addressed in the subsequent chapter.

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In the period from 1946 to 1954, often referred to as the wild years, the early years of Wismut were characterised by ruthless exploitation of resources, extensive environmental destruction and great human suffering (Fengler et al., 2014). Shaped by the trauma of the Second World War, widowed women and children in particular had to fend for themselves in a time of scarcity (Schütterle, 2010: 32). The forced recruitment of workers began in 1946, even before Wismut was officially founded, when the Soviet Union introduced a system of enforced labour to meet its needs (Karlsch and Zeman, 2008; Bretschneider, 1997). All available workers, including refugees, displaced persons, political prisoners, and war returnees, as well as the elderly and children, were recruited (Schütterle, 2010). During this period there was a rapid influx of workers into the mining towns, exacerbating the shortage of food and housing. There were repeated cases of theft and violent attacks. Many local people were displaced or dispossessed: "Mining came before property" (Fengler et al., 2014: 30, translated by the author). Military ore exploration continued to serve nuclear weapons production's overarching strategic security objective. The discovery of uranium deposits in eastern Thuringia in 1950 led to a further intensification of mining activities and thus to considerable ecological and social impacts – "mines grew, and villages disappeared" (Fengler et al., 2014: 32, translated by the author). This phase also marked the formation of a distinct risk landscape, shaped by radioactive materials, unstable tailings, and the infrastructures of a highly militarized extractivism. Inadequate health, safety, and environmental protection led to critical working conditions. The absence of skilled workers frequently resulted in accidents. Many trade union leaders were inundated with complaints about labour and health problems (Bretschneider, 1997). There is evidence of an ambivalence that had a lasting effect on uranium mining in the Ore Mountains. Residents feared for their land, and workers feared for their health, but these impacts were accepted in exchange for a daily hot meal, alcohol and additional food rations for the family (Fengler et al., 2014). Even under these extreme conditions, everyday routines – from the organization of meals to recurring work practices – shaped both a sense of predictability and familiarity as well as a normalization of living conditions. This 'power of the everyday' illustrates how hazardous and harsh circumstances become embedded in daily life and will be further explored in Chapter 3 as part of nuclear cultures.

From the mid-1950s to the end of the 1970s, a structural change took place at Wismut. The focus shifted from short-term exploitation to long-term, highly skilled mining (Fengler et al., 2014). In order to attract skilled workers, the company switched from compulsory to voluntary employment with social incentives (Bretschneider, 1997; Karlsch and Zeman, 2008). To increase productivity in uranium mining, efforts were made to improve working conditions regarding radiation and fire protection, to enhance safety measures and to offer privileges to workers and their families (Fengler et al., 2014). Workers and their families had access to health, cultural, sporting and educational programmes that were integrated into the operational structures of Wismut. The GDR's involvement in the companies signalled a move towards more stability and professionalism in the industry and underlined Wismut's

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unique status as a two-state enterprise. Despite these improvements, challenges such as dwindling uranium reserves and rising production costs placed a significant economic burden on Wismut and its stakeholders (Fengler et al., 2014).

Beginning in the early 1980s, the closure of Wismut was gradually announced. Despite efforts to modernise and improve safety measures, the economic viability of uranium mining became increasingly precarious. Declining reserves, rising production costs and changing geopolitical dynamics led to the closure of Wismut after the end of the Cold War and German reunification in 1990 (Fengler et al., 2014). The closure of Wismut steered to significant economic and social disruption for thousands of workers and their communities and highlights the complex legacy of uranium mining in the Ore Mountains (Schütterle, 2010).

Throughout its history, Wismut's uranium mining operations reflected the broader socio-political context of East Germany and the Soviet Union, which was heavily influenced by military security concerns against the West. The different phases influenced the realities and everyday experiences of those involved. At the same time, these historical phases illustrate how deeply East German uranium mining was embedded in the spatio-temporal logics outlined in the previous chapter: it produced new spatial orders – through expropriations, militarized zones, specialized settlements, and nuclear infrastructures – while simultaneously generating long-term temporalities of risk, illness, and environmental contamination. The delayed health effects and the persistence of radioactive legacies point to forms of slow violence that only materialize over decades.

Thus, the end of active mining does not mark a conclusion, but rather the starting point of a new phase, deeply embedded in these spatio-temporal entanglements. Whereas the early years of Wismut were governed by military logic, short-term extraction, and geopolitical urgency, the post-1990 period opens a different perspective on the landscapes and infrastructures of uranium mining – a perspective shaped by questions of responsibility, the temporal reach of radioactive contamination, and the transformation of toxic spaces. This shift forms the point of departure for Chapter 2.2, which traces the transition from uranium supplier to environmental remediator and demonstrates how spatio-temporal orders are reconfigured in the process of remediation.

2.2 From uranium supplier to environmental remediator

The remediation of former uranium mining regions is not merely to be understood as a retrospective technical process, but as an intervention that itself generates new temporalities, futures, and forms of remembrance. Remediation is therefore more than a matter of clearing up: it produces new temporal

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scales by determining how long radioactive legacies must be monitored, contained, or managed, and by shaping the social, political, and material relations that emerge from these obligations (Makhijani, 2000). This applies all the more given that *"all radioactive wastes start with one substance: uranium"* (Gerrard, 1994: 25). Uranium mining thus constitutes not only the beginning, but also the long shadow of the nuclear fuel and weapons complex.

Yet the temporalities of the nuclear are shaped not only by the phase of extraction, but also by life with the ever-accumulating, long-lived radioactive wastes. Injustice therefore arise not only in the selection of mining regions, but are reproduced in decisions concerning interim and final waste storage sites. In formerly colonised regions and on the lands of Indigenous communities, the consequences of mining were often never remediated; at the same time, these territories continue to be targeted for the disposal or transport of high-level radioactive materials – processes that are frequently rendered politically and infrastructurally invisible (Churchill and LaDuke, 1986; Runyan, 2022). Growing Indigenous protest movements, such as the resistance of the Ojibway First Nation in north-western Ontario, have made the persistence of these inequities increasingly impossible to ignore (Runyan, 2022).

Historical experience – particularly in the United States – also shows that mine tailings and residues from uranium extraction have produced significant and often neglected health and environmental consequences. Gerrard (1994) notes that until the 1960s, uranium mill tailings were in some cases used in construction, leading to the later contamination of thousands of buildings. The vast majority of radioactive residues, however, were deposited in extensive piles or ponds; catastrophic events such as the dam breach at Churchrock (New Mexico) in 1979 illustrate the risks of insecure waste storage and the far-reaching contamination of soils and waterways that particularly affected Navajo lands. Such cases underscore the fact that contamination from waste piles spreads both above ground, through atmospheric processes, and below ground, via groundwater systems – and that a long-term, carefully designed strategy for managing nuclear legacies is indispensable (Gerrard, 1994).

Against this backdrop, the decommissioning phase of East German uranium mining sites (see figure 1) and the transformation of Wismut from a uranium producer into an environmental remediation enterprise appear as part of a global history of nuclear responsibility: a process in which spatial and temporal orders are renegotiated, inequalities perpetuated or challenged, and long-term obligations towards human and environmental wellbeing articulated.

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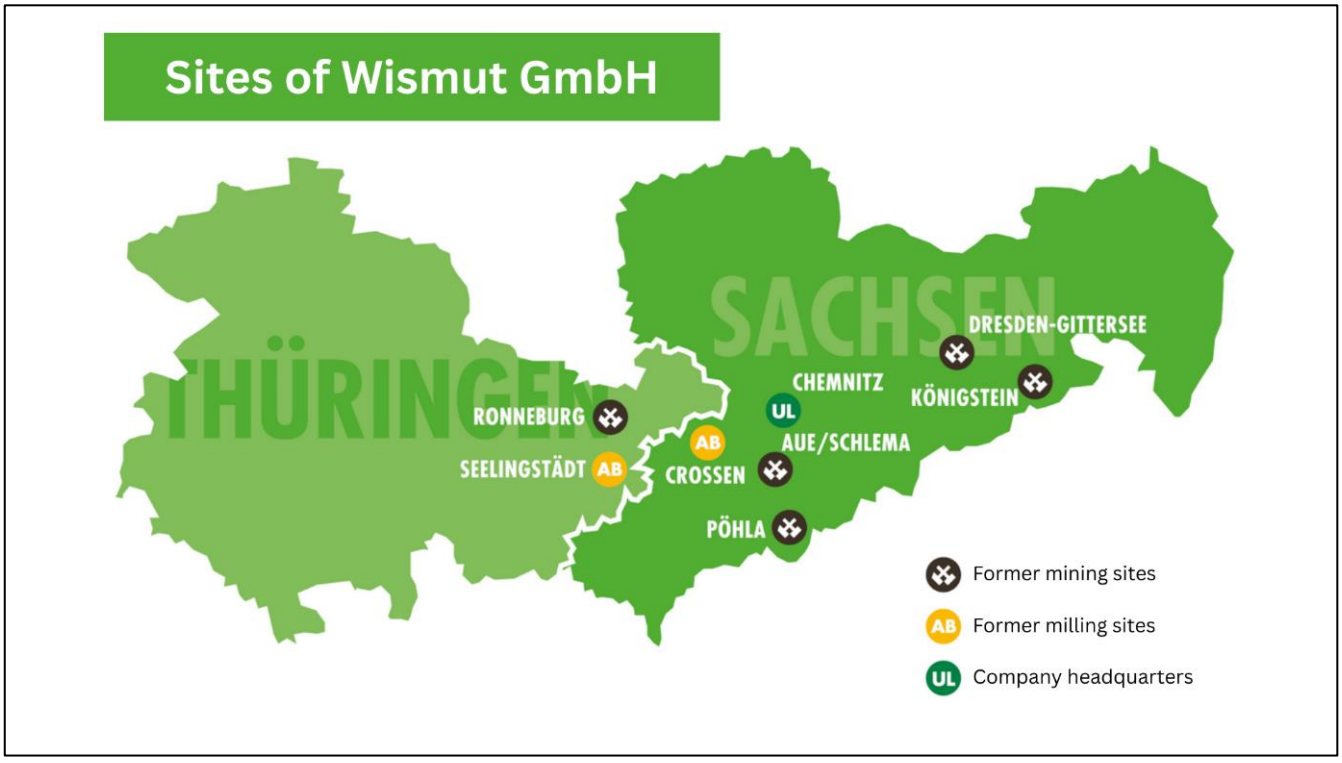

(**Figure 1.** Map of the former sites of Wismut GmbH. Source: Wismut GmbH. Translated into English by the author.)

With the beginning of Mikhail Sergeyevich Gorbachev's presidency in 1985, a profound political reform process began in the Soviet Union, which swiftly extended to numerous state-controlled industrial sectors – including the German-Soviet company Wismut. Even during the ongoing phase of uranium extraction, initial shafts were dismantled, and by 1989 the decommissioning of the sites in Zwickau and Dresden, as well as the complete cessation of operations by 2021, had been decided. In this context of transformation, an agreement to protect employees from rationalisation was pursued, aiming to cushion the social impact of the gradual withdrawal from uranium production. However, the political turnaround and the premature termination of uranium mining at the end of the Cold War generated considerable social insecurity regarding Wismut's future. In the mining-dominated region around Ronneburg in particular, fears over livelihoods and prospects for the future led to strikes, with demands that the rationalisation protection agreement be upheld despite the early closure (Fengler et al., 2014; Wismut GmbH, 2010).

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One of the greatest challenges of the impending remediation concerned the material legacies of uranium mining: more than 160 million m³ of radioactive waste from uranium ore processing, approximately 300 million m³ of moderately radioactive waste rock, and a total area of roughly 3,700 ha of contaminated waste rock piles, tailings deposits, and operational sites (IAEA, 2018). To develop a strategic reorientation, a working group was formed with the involvement of experts from the Ministry of Energy and Geology to evaluate Wismut's future role. The result of this political repositioning was the 1991 assignment of Wismut to the decommissioning and comprehensive remediation of areas contaminated by uranium mining. Moreover, as material contaminated with naturally occurring radionuclides had also been left behind, a comprehensive, long-term, and technically demanding remediation strategy was indispensable. Although the Soviet Union initially declared its intention to remain a shareholder in Wismut to maintain a presence in Germany, it fully withdrew shortly before its collapse, in view of the escalating costs (IAEA, 2018; Wismut GmbH, 2010).

The repurposing of Wismut from one of the largest uranium suppliers of the Eastern Bloc to an environmental remediation enterprise was motivated not only by political pragmatism but also by logistical and technical considerations. On the one hand, the company was to be preserved as a federal enterprise to prevent mass redundancies and to ensure structural continuity in the region – a model comparable to the institutional transformation of other authorities and large-scale enterprises in East Germany. On the other hand, an immediate withdrawal and abandonment of mining infrastructure was technically unfeasible: the hazardous legacies of decades of uranium mining – particularly contaminated land, open shafts, and radioactive residues – necessitated a qualified and long-term remediation strategy. The specialists employed at Wismut possessed unique experiential knowledge and expertise in radiation protection, which was indispensable for the safe decommissioning. The very engineering skills that had once planned and constructed the shafts were now required to dismantle them according to the highest safety standards. Simultaneously, personnel matters were handled with differentiation: particularly at the leadership level, employees were subjected to critical scrutiny concerning their past activities for the Ministry for State Security, leading in several cases to their exclusion from continued service.

Against this backdrop, Wismut's transformation emerged as a structurally significant anchor process: during a period of profound upheaval, it provided a measure of institutional stability – both for the affected region and for the management of the ecological legacies of uranium mining. This new role as an environmental remediator was not only politically necessary but also represented, in technical terms, one of the greatest industrial-ecological challenges in the aftermath of the Cold War.

The cessation of mining activities – particularly those involving radioactive residues – constitutes an extremely complex process, extending far beyond the mere closure of shafts (Makhijani, 2000; Yih et al., 2000). Every mining operation is by definition finite; however, the crucial issue lies in how this

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finitude is managed. A professionally conducted decommissioning aims for safe, environmentally sound, and as cost-efficient a post-mining use as possible. Ideally, precautionary mechanisms such as remediation funds would have been established during the active phase of extraction. Yet neither economically nor ecologically did uranium ore mining in the GDR adhere to sustainable principles, resulting in a considerable subsequent effort to rectify the damage incurred (Fengler et al., 2014).

Decommissioning is governed by the Federal Mining Act (Vitzthum, 2013) and the Radiation Protection Act (Bundesamt für Justiz, 2017) and is monitored by Euratom (IAEA, 2018). Under German mining law, the first step in decommissioning is to guarantee public safety. In order to meet this requirement, strict criteria must be fulfilled: exposure limits for ionising radiation, the geomechanical stability of remaining voids, and the protection of the biosphere, air pathways, and water systems must be systematically assessed. Based on these evaluations, specific decommissioning and remediation solutions are developed, the implementation of which is subject to authorisation by a range of specialised authorities – such as those responsible for radiation protection, nature conservation, and water management.

Wismut GmbH was tasked not merely with securing mining-affected areas but with rendering them fully utilisable – whether for residential, commercial, or recreational purposes. This required that operational areas be deconstructed and decontaminated to the extent that no residual risks remained for future uses. This is not a short-term endeavour but one projected over decades: aftercare, monitoring, and technical maintenance of the remediated areas form part of a so-called ‘eternal task’, a concept otherwise familiar primarily from radioactive waste disposal sites. The long-term objective of Wiedernutzbarmachung (reusability) in accordance with § 4(4) of the Federal Mining Act simultaneously raises questions concerning the safeguarding of remediated sites and the communication of residual risks to future generations, issues that will be examined in greater detail in Section 3.2 (Vitzthum, 2013).

One of the central technical challenges lies in the management of spoil heaps (see figure 2) – artificially accumulated waste deposits that often contain high concentrations of radioactive residues and heavy metals. These can release contaminants into the environment via water erosion, wind dispersal, or diffusion (Yih et al., 2000). To minimise such risks, spoil heaps are sealed, technically encapsulated, and surface-capped. Particular attention is paid to the water pathway: leachate accumulating at the base of the heaps often exhibits highly elevated levels of pollutants. To prevent its migration into groundwater, it is captured via drainage systems and subsequently treated in specially designed water treatment facilities (IAEA, 2018; Wismut, 2010).

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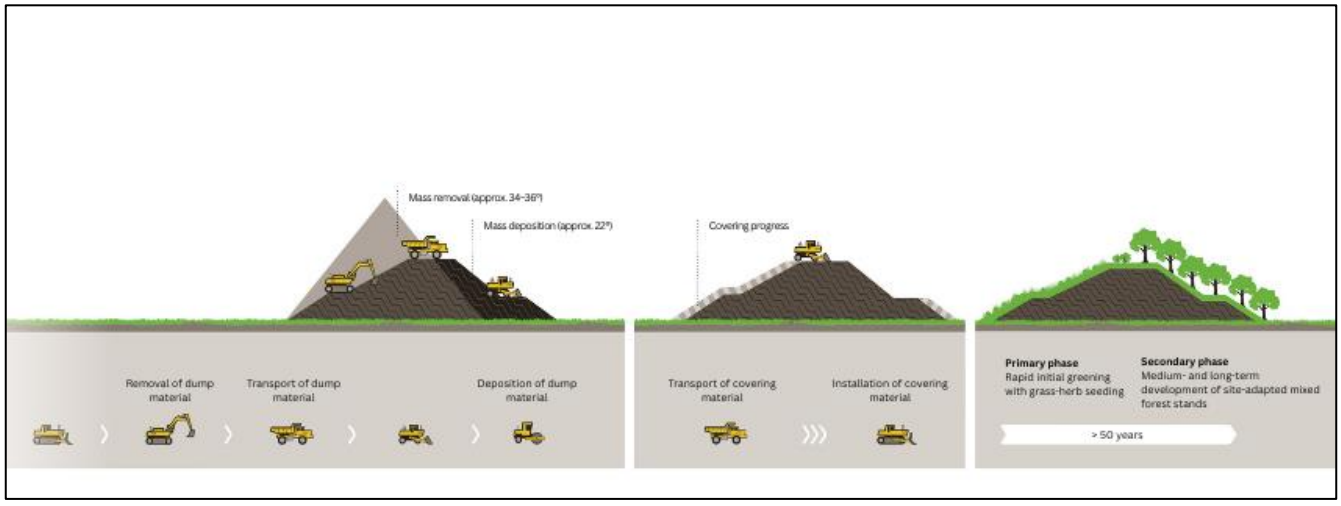

(**Figure 2.** Schematic diagram of the technology for waste rock pile remediation. Source: Wismut GmbH. Translated into English by the author.)

The air pathway also requires continuous monitoring. Radon, a noble gas and decay product of uranium, emanates from spoil material and can reach health-endangering concentrations in the ambient air under certain conditions (Yih et al., 2000). The effectiveness of seals largely depends on local topographical features – such as low wind speeds in valley locations or temperature inversions. Here too, long-term monitoring is indispensable, especially as vegetative covers can lose their protective functions over time.

Technical challenges are particularly pronounced in underground mining, where extraction extended to depths of up to 2,000 metres. Operational materials used there – oils, greases, technical chemicals – pose a latent threat to groundwater, especially if mobilised by rising mine water. As active water management is reduced, mine water levels gradually rise. To maintain control, an elaborate monitoring system was developed: water levels are automatically recorded, managed via a water management system, and buffered through safety reservoirs in the event of exceedances. Contaminated mine water is treated in modern plants, with approximately two-thirds of total remediation costs allocated to this area.

Wismut GmbH operates water treatment facilities at several former uranium ore production sites – including Ronneburg, Seelingstädt, Helmsdorf, Pöhla, Schlema, and Königstein – with capacities ranging from approximately 50 to 1,100 m³ per hour. To remove radioactive substances such as uranium, radium, thorium, lead, and polonium, lime precipitation processes are predominantly employed, adapted to local geological and hydrological conditions. At the Königstein site, however,

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uranium is separated from the mine water by ion exchange prior to lime precipitation due to the particularly high uranium concentrations. Uranium recovery followed by the sale of the recovered metal also generated a modest economic return (IAEA, 2018).

The remediation practices of Wismut GmbH contribute significantly to the ecological stabilisation of the former uranium ore mining regions. Through continuous water treatment and technical containment measures, the input of uranium into surface waters is reduced, while materials that cannot be reused or recycled are stored in specially designed long-term disposal facilities pursuant to § 149 of the Radiation Protection Act. These facilities are engineered to ensure that environmental impacts remain minimal over several decades. The technologies and procedures developed during remediation are now considered international reference models for the management of uranium mining legacies, an aspect explored in greater detail in Chapter 3.2 (IAEA, 2018).

These measures are by no means a concluded technical act but constitute an ongoing, long-term process that continuously transforms the landscape and its social, material, and temporal configurations. In the sense proposed by Haraway and Barad, decommissioning can thus be understood as an intra-active process in which material, temporal, and social assemblages are inseparably entangled. The visible traces of uranium production may fade, yet the transformations in landscape, collective memory, and epistemic infrastructures persist – quietly, gradually, and embedded in everyday life. Against this backdrop, the technical and administrative management of these legacies forms the resonance space for the nuclear culture examined in the following chapter. It demonstrates how extraction, decommissioning, and remediation have shaped nuclear culture over time and how these dynamics are reflected in ambivalences, traces of trauma and memory, heritage discourses, and archives of knowledge. In this way, it becomes apparent that the legacy of uranium mining endures not only ecologically but also culturally and epistemically.

3 Nuclear culture and the spatio-temporal afterlives of uranium mining

Chapter 3 foregrounds those dimensions of uranium mining that cannot be captured in tonnes of extracted ore, radiation protection limits, or remediation budgets, but manifest instead in lived experiences, images, identity, memories, and knowledge archives. Whereas Chapter 2 traced the spatio-temporal entanglements of uranium extraction and remediation in eastern Germany primarily through materialities, political processes, and long-term temporalities, this chapter examines how these entanglements materialise in specific nuclear cultures. In doing so, it underscores that any strict division between ‘materiality’ and ‘culture’ is analytically untenable. Radioactive substances, infrastructures, and

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remediation practices function as carriers of meaning, emotion, and social relations; conversely, cultural imaginaries of risk, futurity, justice, or remembrance are materially instantiated in concrete technological and environmental arrangements.

This entanglement becomes particularly evident in theories of material memory, such as those articulated by Barad (2017). In her materialist-feminist approach, Barad describes the persistence of violence and memory as an onto-epistemological process in which "attempts at erasure always leave material traces" (Barad, 2017: 70). Erasure, in this sense, never signifies complete disappearance, but marks itself as a trace "into the very fabric of the world" (ibid.). Kyoko Hayashi's (2007) literary engagement with the site of the first nuclear weapons test vividly demonstrates that the earth itself has become a bearer of inscriptions of violence: "There were elderly victims here" (ibid.: 168). Past and present diffractively fold into one another, reconfiguring themselves through the encounter of body and place. Memory appears as a corporeal–material re-experiencing, as a "material reconfiguring of spacetimemattering" (Barad, 2017: 71). This perspective opens up new pathways for analysing the nuclear cultures of uranium mining in eastern Germany: the slow, sedimented forms of nuclear violence inscribe themselves into landscapes, bodies, and archives, rendering memory, trauma, and knowledge visible as material entanglements.

Drawing on debates on energy cultures, nuclear culture can be understood as a specific configuration of energy cultures shaped by political-ideological frameworks, technological regimes, and imagined futures (Mbah et al., 2025). Carpenter (2016) conceptualises nuclear culture as a constellation of practices, representations, and material engagements through which societies confront the historical, technological, and ethical implications of the nuclear. It encompasses both material forms – such as mines or waste management infrastructures – and 'aesthetic' or everyday expressions, making visible how 'the nuclear' is produced, represented, and experienced (Carpenter, 2016). In this sense, nuclear cultures are marked by a fundamental tension: between the extraordinariness of the nuclear as a source of existential threat and geopolitical power, and processes of normalisation, domestication, and banalisation (Carpenter, 2016; Mbah et al., 2025).

This tension is captured succinctly in Hecht's (2012; 2014) notion of 'nuclear exceptionalism'. "Nuclear things" are understood as fundamentally distinct from "ordinary things" (Hecht, 2014: 6); at the same time, Hecht shows that 'nuclearity' is not an inherent property of matter but the outcome of political interests, economic objectives, and epistemic frameworks (Hecht, 2014; Keating and Storm, 2023). The categorisation of something as nuclear is therefore always bound to a "spatio-temporal milieu" (Keating and Storm, 2023: 102). Uranium mining occupies this in-between position: while it is highly security-relevant due to radiation exposure and its military significance, it has simultaneously been rendered mundane in many (post)colonial and state-socialist contexts of extraction. This simultaneity of

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exception and banality, secrecy and everyday embeddedness forms a central starting point for analysing the nuclear cultures of uranium mining in eastern Germany.

Nuclear cultures are neither homogeneous nor static. They emerge in relation to national identities, energy policy paradigms, and local lifeworlds. Smith (2010), for example, demonstrates how national self-understandings in France are closely intertwined with the nuclear project, whereas Hogg (2012) shows, in the British context, how nuclear deterrence, atomic diplomacy, anti-nuclear protest, and everyday consumer culture (from the CND logo to the 'atomic submarine' in a cornflakes box) shaped notions of nationhood, the future, and personal existence after 1945. Such studies illustrate how nuclear culture permeates both high politics and everyday life, producing feelings of powerlessness, uncertainty, anxiety, ambivalence, and hidden forms of resistance (Hogg, 2012). In a similar way, the working and living environments surrounding Wismut can be read as part of a specific East German nuclear culture in which socialist hero narratives, secrecy, identity formation, health risks, and later nostalgias intersect.

At the same time, nuclear culture points beyond the local, towards glocal entanglements: uranium mining in eastern Germany is embedded in transnational nuclear fuel chains, security regimes, and knowledge networks whose traces appear in landscapes, archives, and memory politics. Concepts such as nuclear cultural heritage (Mbah et al., 2025; Rindzevičiūtė et al., 2024; Ross, 2024) and nuclear memory (Keating and Storm, 2023) underscore that nuclear infrastructures generate spatio-temporal legacies that persist as material heritage, collective memory, and transmitted knowledge – processes that are always shaped by social inequalities, political agendas, and contested visions of the future. These approaches highlight not only how nuclear pasts are curated and negotiated, but also how responsibilities towards nuclear futures are imagined and institutionalised.

Against this backdrop, Chapter 3 adopts a deliberately entangled analytical approach that does not treat nuclear culture as a separate cultural sphere alongside technology and politics, but as a nexus in which materiality, temporality, power, and everyday experience intersect. Section 3.1 examines the lived dimensions of this culture: practices of secrecy, ambivalences of pride, risk and vulnerability, traces of trauma, and forms of nostalgic retrospection on Wismut as a working and living environment. Section 3.2 then shifts attention to transformations of memory and knowledge: processes of heritagisation, the role of archives and museums, Wismut's integration into international knowledge networks, and the question of how nuclear knowledge and responsibility can be communicated into the future.

The guiding thread connecting both subsections is the question of how extractive and post-extractive temporalities generate nuclear culture – and how this culture continues to shape what is remembered, forgotten, rendered visible or invisible in eastern Germany. By approaching the uranium mining regions of eastern Germany as sites of nuclear culture, they become legible not only as locations of

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environmental legacies but also as laboratories for negotiating identity, memory, responsibility, and knowledge in the nuclear age.

3.1 Nuclear culture and everyday ambivalences: Living between the ordinary and the exceptional

The cultural and everyday dimensions of uranium mining in East Germany can only be understood when situated within the spatio-temporal entanglements of the Cold War, Soviet nuclear policy, and the later transformation from extraction to remediation. Wismut's uranium mining was not merely a military-industrial megastructure but a social world in which geopolitical power relations, material exposures, regional identities, and personal life trajectories intersected. Nuclear culture, as Hogg (2012) demonstrates, penetrates deeply into collective identities and manifests in everyday practices, media representations, and educational systems. Societies integrate nuclear infrastructures into their self-understandings, thereby making nuclear heritage an element of everyday experience (Hogg, 2012). In the Wismut context, too, it becomes clear how profoundly culture, identity, and everyday life were shaped by the presence of the nuclear – and how differentiated these experiences were.

Nuclear culture was, and likely never will be, homogeneous: it is experienced differently across generations and varies according to regional context. In East Germany, regional and historical path dependencies played a decisive role. In the Ore Mountains – a historic mining region whose traditions date back to the Middle Ages and which is now recognised as a UNESCO World Heritage site – mining was deeply rooted in cultural self-understanding. Uranium extraction was seen as extending a long tradition of prosperity-producing industrialisation. A specific sense of tradition had crystallised: eight centuries of intertwined mining and industrial development shaped the ideal of the miner as a 'creator of prosperity', reflected in the idiom "Ich bin Bergmann, der ist wer/ I'm a miner, I'm a miner – that's someone" (15.08.2023)[1]. Identity emerged from immense labour, extreme risks, and the resulting pride in one's occupation – uranium mining was a life's work not accessible to all. By contrast, uranium mining in Ronneburg was far less embedded; in regions such as Saxon Switzerland, including Königsstein, it clashed with local self-understandings of the area as a protected landscape (Fengler et al., 2014). Here, Wismut workers were perceived as "Heuschrecken/ locusts" (14.08.2023) invading previously untouched terrain.

Despite this diversity, those embedded in the 'Wismut world' shared a common experiential horizon: nuclear culture meant living with ambivalences. In East German uranium mining, five key tensions can

[1] Due to the sensitivity of the research topic, all conversations are fully anonymised. For transparency, they are referenced by date, noting that multiple conversations took place on the same day. In order to reflect the nuances and affective textures of participants' expressions, key excerpts are reproduced in the original German. An English translation is provided by the author, with careful attention to linguistic accuracy and contextual integrity.

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be identified that shaped this experience: between 1) exceptionalism and banalisation, 2) risks and privileges, 3) destruction and infrastructure, 4) secrecy and everyday life, and 5) trauma and nostalgia. The following sections unfold these ambivalences to show how they not only reflected but actively produced East German nuclear culture.

The ambivalence between exceptionalism and banalisation forms a central point of departure for understanding nuclear culture in East German uranium mining. The political and ideological staging of the nuclear as something inherently extraordinary paradoxically generated processes through which nuclear labour became ordinary on the ground (Hecht, 2014). While nuclear weapons were fetishised in global discourse as symbols of technological superiority and geopolitical power, the GDR deliberately framed uranium mining as a largely conventional form of mining to generate acceptance and obscure its security-political significance. In workers' everyday lives, this framing normalised the nuclear – a process reinforced through routinised work practices, the public taboo surrounding the nuclear, and an abstraction of one's own exposure. As Mbah et al. (2025) argue, nuclear cultures are characterised by such contrasting imaginaries. Wismut's uranium mining exemplifies this tension: the simultaneity of geopolitical exceptionalism and local banalisation profoundly shaped cultural meanings, perceptions, and memories.

A second ambivalence unfolds in the relationship between risks and privileges. This tension is historically rooted in the Ore Mountains, where mining had long entailed struggles for privileges. Under Wismut, this dynamic was transformed: high wages, exclusive provisioning systems, access to scarce consumer goods, and extensive social and cultural services were privileges rarely available elsewhere in the GDR. They generated loyalty within a system that exposed workers to severe physical strain and health risks. Wismut's uranium extraction must be understood within the security logics of the Cold War: the population experienced a double threat – from the nuclear arms race itself and from the health and social burdens resulting from participation in Soviet weapons production. Wismut constituted a sealed-off microcosm whose infrastructure served not primarily to protect workers but to ensure uranium deliveries (Schütterle, 2010). The enterprise was never economically profitable; its sole purpose was military (Fengler et al., 2014). This is echoed in a common saying: "Das bisschen Uran, das wir für die Kernkraftwerke brauchen, das kratzt man mit 'nem Helm raus … Dafür brauchten sie die Wismut nicht/ The bit of uranium we need for the power plants, you could scrape that out with a helmet … they certainly didn't need Wismut for that" (17.8.23). To achieve its goals, Wismut created an extensive system of subsidiary enterprises, provisioning services, specialised healthcare, telecommunications and transport systems, and an autonomous fire brigade (Schütterle 2010; 15.8.23). A system of existential dependence emerged in which social advantages and economic security coexisted with severe hazards.

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Although occupational safety and radiation protection measures formally existed from the 1960s, testimonies indicate that performance pressure frequently led workers to circumvent them: “Wir haben Staub gefressen, um den Plan einzuhalten/ We ate dust to meet the targets” (17.8.23). This interweaving of risk and privilege generated a moral and existential ambiguity that became constitutive of Wismut culture. Soviet-style socialist competition further consolidated this identity through camaraderie, mutual dependence, and a comprehensive social infrastructure. These dynamics were inseparable from the historical experiences of the Second World War. Uranium mining also enabled the transformation of negative experiences and war trauma by promoting education, community, and culture in line with Soviet ideological aims. Such authoritarian structuring facilitated societal acceptance. Regional identity materialised in everyday symbols such as the miner’s greeting ‘Glück auf/ good luck’, motorway signs declaring ‘Willkommen im Schacht/ Welcome to the shaft’, or pride in mining uniforms and traditional sports and cultural associations. These elements persist today. For instance, opposite the school in Aue-Zelle, one still finds a former Soviet mural proclaiming ‘Ore for Peace’, depicting a peace dove paired with mining imagery (see figure 3).

(**Figure 3.** Photograph by the author, 16 August 2023. Building opposite the primary and secondary school in Aue-Zelle.)

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A third ambivalence arises from the simultaneous experience of large-scale destruction and extensive infrastructural development. The Soviet ‚uranium hunger' meant extraction proceeded without regard for settlements or the environment: "Mining took place where strategically valuable ores were suspected to be found, in the middle of villages, between residential buildings and in gardens" (Schütterle, 2010: 30, translated by the author). Subsidence, landslides, and damaged pipelines shaped everyday life (Karlsch and Zeman, 2008). At the same time, Wismut established sports, educational, and cultural programmes strongly influenced by Soviet ideology – building a distinct "Wismut culture" (Bretschneider 1997: 31, translated by the author). By integrating miners' families into this infrastructure, it became intergenerationally identity-forming: "Es entstand neues Heimatgefühl über den Bergbau/ A new sense of home grew out of the mining" (6.9.23). The dual movement of destroying existing spaces while creating new infrastructures produced ambivalent experiences of belonging, adaptation, and identity. Bickerstaff's (2021) concept of 'quiescence' suggests that proximity to nuclear infrastructure can paradoxically create calm and familiarity because risks become normalised, displaced, or overshadowed by economic dependence. Yet, as I emphasise, this is less passive acceptance than a place-based identity shaped through slow nuclear violence, fostering endurance, resistance, and everyday coping strategies.

A fourth ambivalence characterises the relationship between secrecy and everyday life. Wismut's uranium mining was permeated by an intensive Soviet-East German secrecy regime, justified through geopolitical confrontation with the West, with severe consequences for dissent: "Wenn du Gegen Uranabbau bist, dann biste gegen Frieden/ If you are against uranium mining, you are against peace" (15.08.2023). At the same time, workers' everyday routines – passport checks, food coupons, clothing and shift changes – embedded nuclear labour into daily normality. The invisibility of radioactivity and the epistemic opacity of state information policies heightened uncertainty and distrust (Mbah and Kuppler, 2024). Wismut was sealed off as its own world. A comprehensive secrecy apparatus intensified social isolation: conversations stopped when 'Wismut' was mentioned; internal code words, encrypted communication, and strict access controls shaped workplace life; private contacts required authorisation (Fengler et al., 2014). Violations were harshly sanctioned (6.9.23). This atmosphere of continuous control had deep psychological effects and obscured the negative aspects beneath the constructed banality of uranium mining. Comparative insights from Indigenous uranium mining regions – such as the Navajo Nation, where miners worked "uninformed and unprotected" (Runyan, 2022: 1155) – reveal that secrecy and lack of information are structural features of nuclear labour. In the East German case, this produced collective speechlessness, internalised adaptation strategies, and lasting consequences for memory cultures and the transmission of knowledge.

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The fifth ambivalence unfolds between trauma and nostalgia. With the post-Soviet upheavals, the abrupt loss of employment, identity, and social security, and the increasing visibility of ecological and health consequences, East German Wismut regions experienced a form of "cold war nostalgia" (Von Eschen 2022, 134), also observed in the USA and the former Soviet Union. Nostalgia – as Egeland (2020) argues – is a selective mode of remembrance that actively reconstructs the past and addresses contemporary insecurity. Psychological mechanisms such as 'rosy retrospection' and 'immediacy bias' (Fettweis, 2019; Van Boven et al., 2009) mitigate negative memories and amplify positive ones, thus converting ambivalences into apparent clarity. Schwab (2023) highlights the temporal depth of nuclear trauma: transgenerational nuclear trauma "encompasses past, present, and future" (Schwab, 2023: 47) and shapes how experiences of burden, danger, and loss are processed, suppressed, or romanticised. Garde-Hansen and Jones (2012) underscore that memory is inseparable from space, bodies, and materiality – a dynamic visible in the mining regions of East Germany. The tabooing of health risks, everyday minor injuries and retraumatisations, and the need for social resilience often produced an abstraction of trauma, opening space for idealised recollections of 'Wismut culture'. Shared suffering simultaneously had community-building effects: it generated collective forms of endurance and contributed to identity formation. For many, nostalgia became a coping mechanism – a means of stabilising continuity, meaning, and belonging in the face of stigma, social decline, and uncertainty, while for others, truth-telling served as a form of processing and reclaiming their history[2].

Overall, nuclear culture in the East German uranium-mining regions is marked by a dense web of everyday ambivalences that cannot be resolved or clearly evaluated. It emerged in a context in which all spheres of work, life and knowledge were subordinated to the overarching military-strategic logic of nuclear deterrence and the fulfilment of Soviet uranium targets – a structural condition that became deeply inscribed in perceptions, practices and cultural self-understandings. These ambivalent tensions are an expression of the spatio-temporal entanglements of the Cold War, Soviet nuclear interests, socio-economic transformation and post-extractive life worlds. Living with the nuclear here means experiencing, simultaneously, pride and vulnerability, belonging and isolation, normality and danger, memory and forgetting. Taken together, these ambivalences reveal how profoundly the nuclear past is embedded in bodies, landscapes, and social relations – and how it continues to shape identity, memory cultures, and imagined futures to the present.

[2] Similar patterns of nostalgia following extraction-driven settlement decline can be observed in Uranium City, Saskatchewan, Canada – a community built around uranium mining that developed strong emotional bonds to mining infrastructures, normalised exposure, and later experienced profound feelings of loss and selective remembrance (Boschmann, 2018; Keeling, 2010; Walby, 2017).

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3.2 From local memory to global networks: The future of uranium mining knowledge

Knowledge archives and cultural forms of remembrance play a pivotal role in the context of the Wismut uranium mining complex – as well as in other regions shaped by nuclear resource extraction. They not only preserve historical records and technical documentation but also function as crucial sites through which past, present and future nuclear cultures are negotiated. As Rindzevičiūtė et al. (2024) argue, the self-understanding of nuclear communities shifts as their visions of the future change; memory, identity and belonging are continuously redefined. This is particularly evident in the former uranium mining regions of East Germany, where questions of nuclear heritage and long-term responsibility materialise simultaneously in local practices and in globally connected knowledge and governance networks. The following analysis, structured along the three axes of *memory and heritage*, *knowledge infrastructures* and *future temporalities*, examines how local nuclear knowledge circulates translocally and globally, how it becomes institutionalised, and what role it plays in shaping long-term futures.

3.2.1 Memory and heritage

At the local level, knowledge archives fulfil a dual function: they preserve historical realities while also enabling the negotiation of collective memory. In the Wismut regions, this is vital precisely because the lived experiences of affected communities are marked by profound ambivalence. Archives, museums, local associations and voluntary heritage groups form central arenas of this engagement, providing spaces in which multiple perspectives can be recalled, contextualised and documented, and through which the social and material imprints of uranium mining on everyday life become legible.

Analytically, these processes can be situated within debates on nuclear cultural heritage (NCH), a concept that Rindzevičiūtė et al. (2024) define as the "practice of collecting, storing, archiving, preserving and caring" (Mbah et al., 2025: 2) for the material and immaterial elements of nuclear culture. NCH encompasses artefacts, documents and technical objects as much as intangible practices, narratives and rituals – pointing to the inherent duality of the nuclear (Hecht, 2014): simultaneously abstract and material, ordinary and exceptional, locally situated yet globally entangled.

In the Wismut regions, this duality is reflected in literature, diaries, letters, photographs, drawings, technical records, worker narratives and institutional documents that operate as a 'time capsule' of labour conditions, health impacts, environmental damage, displacement, and the shifting political landscape and power relations in which uranium mining was embedded. These archival practices take on added significance in light of the nostalgic reframing that often emerges in oral histories over time. Critical preservation of a broad set of sources thus becomes essential to maintaining a differentiated picture and preventing memory politics from being dominated by selective narratives alone.

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Yet heritage is never neutral. As Ross (2024: 306) highlights, "nuclear cultural heritage means different things to its different communities", and struggles over what is remembered or forgotten are inherently political. In East German mining regions, this becomes visible in tensions between municipal actors, economic interests, advocacy groups and state institutions over which histories are made visible and who can claim interpretive authority. Existing research demonstrates that nuclear cultural heritage gains particular significance in periods of technological, social and ecological change, as decommissioned sites trigger profound transformations within local communities and necessitate renewed negotiations over long-term safety issues, including the management of long-lived radioactive materials. In this sense, NCH enables these shifts to be understood in cultural and social terms and facilitates the transmission of knowledge about nuclear risks across generations (Mbah et al., 2025; Ross, 2024).

NCH is always embedded within spatial and temporal entanglements (Mbah et al., 2025). As Rindzevičiūtė et al. (2024) emphasise, nuclear infrastructures generate spatio-temporal legacies that endure across generations in local communities, both materially and through knowledge. In regions exposed to radioactive contamination and resource extraction, cultural heritage becomes a means of seeking recognition, restoration and collective orientation. Uranium extraction has produced a "heterogeneous collection" (ibid.: 1) of places, practices, artefacts, bureaucracies and social relations that cannot simply be preserved but are continually reproduced through present-day discourses, emotions and imaginaries of the future. A prominent example is the inscription of the Ore Mountains as a UNESCO World Heritage Site in 2019, including Wismut's Schacht 371 (Mbah et al., 2025). Embedding such sites in international heritage regimes underscores how nuclear pasts are globally networked, politically contested and culturally complex. State and industrial actors are increasingly recognising the value of heritage-based approaches for public engagement, decommissioning and long-term safety cultures – while, at the same time, there remains a risk that key material and immaterial elements of nuclear cultural heritage may be lost or that existing injustices may be reproduced (Rindzevičiūtė et al., 2024). The Wismut Foundation plays an essential role here: it serves as a forum for historical, cultural, and social engagement, curating knowledge, shaping visibility, and inevitably drawing boundaries around what is considered worthy of preservation (Wismut Stiftung).

Memory and heritage in the context of uranium mining are thus never purely retrospective. As Jones and Garde-Hansen (2012) argue, memory is always bound up with space, time, bodies, and materiality – and therefore actively shapes the present and future, informing identity formation and political contestation.

3.2.2 Knowledge infrastructures

While practices of remembrance are deeply rooted in place, the technical and regulatory expertise developed at Wismut circulates globally. Over the course of remediation, Wismut developed extensive

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system knowledge in radiation protection, water treatment, tailings management and long-term environmental monitoring – knowledge that now informs international cooperation and capacity building.

Such knowledge forms part of knowledge infrastructures: institutionalised, standardised and transnationally networked systems that enable the production, transfer and application of expertise. International organisations such as the IAEA play a central role by providing platforms for exchange, standard-setting, and the dissemination of best practices. Wismut collaborates, for instance, with states in South America and Africa to share expertise on radiation protection, monitoring methods and reclamation strategies (Helwig, 2025; IAEA, 2018; Wismut GmbH, 2025). The example of the Rössing mine in Namibia underscores the relevance of these networks: wind and heavy rainfall can cause severe erosion of radioactive tailings deposits, generating significant environmental and health risks and posing major challenges for long-term nuclear safety management (Winde et al., 2017). Here, Wismut's technologies, expertise and procedures serve as crucial reference points.

These collaborations are explicitly non-commercial, aiming to strengthen global professional capacity, knowledge transfer and institutional competence. This resonates with Rindzevičiūtė et al. (2024), who argue that NCH also encompasses the further development and future applicability of nuclear knowledge. Mbah et al. (2025) similarly emphasise that nuclear heritage and nuclear culture are inseparable from technical infrastructures, and that knowledge is not merely preserved but actively co-produced through societal and political engagement.

Knowledge archives – whether digital repositories, institutional systems or forms of embodied local expertise – thus operate not only as storage mechanisms but as dynamic infrastructures that translate historical experience into future-oriented practice. They are spaces of power, determining which knowledge circulates, who has access, and which narratives are reproduced.

3.2.3 Future temporalities

The long temporalities of radioactive materials pose unique challenges for memory, responsibility and communication. Radioactive substances remain hazardous for timescales far exceeding the lifespan of human institutions, political systems or cultural practices. This produces – as Ross (2024) and Mbah et al. (2025) stress – a distinct form of nuclear heritage that interlaces past, present and future. A central challenge lies in how knowledge of such risks can be kept intelligible, accessible and interpretable for future generations. Keating and Storm (2023) describe this as the challenge of nuclear memory: "the problem of how to communicate memory of nuclear things". They argue for approaches that go beyond traditional archives, incorporating aesthetic, material and speculative modes of remembrance. Because

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the future is fundamentally open, it remains uncertain which languages, technologies or social structures will exist to interpret present warnings.

In East Germany, engagement with long nuclear time scales is evident in decades-long monitoring programmes, 'eternal tasks' of remediation, long-term preservation of operational and radiological records and the training of new generations of specialists. These activities are not merely technical but depend on a robust culture of memory in which knowledge is continuously updated and adapted to changing societal contexts. Rindzevičiūtė et al. (2024) warn that key material and immaterial elements of nuclear heritage risk being lost – especially where social inequalities shape the persistence and accessibility of knowledge. Future temporalities thus invoke an ethics of long-term responsibility that understands nuclear pasts not as concluded but as ongoing obligations. The uncertainty of societal development over millennia requires modes of communication that keep knowledge open rather than fixed – a speculative, non-linear orientation as advocated by Keating and Storm (2023).

Engagement with the nuclear legacy of East German uranium mining shows that knowledge – technical, social, material and cultural – is never static. It moves between local memory practices, global technical networks and long-term future responsibilities. The interplay of memory and heritage, knowledge infrastructures and future temporalities demonstrates that nuclear knowledge is always translocal and translational: emerging from specific places, embedded into global systems, and simultaneously held open for future generations. In this sense, Wismut – despite, or perhaps because of, its regional specificity – has become a central node within a global nuclear knowledge regime.

4 Conclusion: Nuclear cultures at the crossroads of security and justice

The analysis of Wismut's uranium mining demonstrates that nuclear cultures extend far beyond technical or security-related dimensions. They are deeply inscribed in social relations, bodies, landscapes and practices of remembrance, and they continue to shape the present – even where physical traces have been remediated, built over or politically marginalised. Most sites of former uranium production worldwide remain invisible, inadequately addressed, and often lack adequate clean-up. This very invisibility stabilises nuclear injustice and displaces risks into the future.

The East German Wismut regions exemplify how closely nuclear cultures are entwined with ambivalence: with the simultaneity of risk and privilege, destruction and infrastructure, secrecy and everyday life, trauma and nostalgia. These ambivalences are not resolvable but express the spatio-temporal entanglements of the nuclear, in which past, present and future are inextricably linked. Schwab

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(2023: 44) underscores that "the temporality of nuclear destruction cannot be confined to the future" – radioactive and psychological harms are part of the lives we inhabit now.

At the same time, these experiences point to a global challenge: the need to decolonise nuclear temporalities (Nichols, 2025). The long-lasting radioactive consequences of uranium extraction, its colonial entanglements and its relevance for contemporary geopolitical orders make clear that responsibility cannot end at national borders, technical standards or temporal horizons. Barad (2017: 56) formulates this as an ethical obligation towards those "who are not yet born or who are already dead" – a mandate of intergenerational justice.

The question of nuclear security and safety is therefore inseparable from questions of nuclear justice. While current debates on a 'nuclear renaissance' foreground CO_2-neutral energy and geopolitical stability, the social, ecological and historical costs of uranium mining are frequently externalised – particularly in regions whose political and economic structures facilitate exploitation. This applies to many areas, for example, in Namibia, Niger, Kyrgyzstan, and Kazakhstan. In the realm of nuclear security, cases such as the continued unsecured state of the Shinkolobwe mine in the Democratic Republic of the Congo – which supplied uranium for the Manhattan Project and has neither been remediated nor properly addressed since its closure – highlight how issues of non-proliferation, the prevention of illicit trafficking of radioactive materials and global inequality are deeply intertwined (Anthony and Grip, 2013: 30; Broodryk and Stott, 2011: 5). Likewise, the long-term ecological and humanitarian harms of decommissioned mining sites point to core challenges of nuclear safety that extend far beyond technical considerations and expose structural vulnerabilities. Without comprehensive social, ecological and historical recognition, the injustices that have accompanied the nuclear from its inception persist.

The Wismut case also demonstrates the transformative potential of memory and knowledge. Local archives, oral histories, museum practices and international knowledge exchanges contribute to embedding the legacies of uranium mining within broader societal learning processes. They underscore that "the relationship between materialities, communities and locations is one of continuous, shifting dialogue" (Ross, 2024: 310). This dialogical understanding is essential to any long-term ethics of responsibility. Only those who understand the past can shape the future. The experiences of Wismut workers and affected regions serve as a reminder not to treat nuclear projects merely as technical achievements, but to systematically consider their implications for people, society and nature.

Yet the fundamental challenge remains: How can knowledge about radioactive materials be preserved for periods exceeding the lifespan of human institutions? How can nuclear memory be communicated to future generations without patronising or underestimating them (Keating and Storm, 2023)? How can a

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global nuclear regime be designed to ensure both security and justice? Engaging with Wismut's nuclear culture makes it clear that technical solutions alone are insufficient. Nuclear responsibility requires historical understanding, social sensitivity, ecological foresight and a willingness to confront the ambivalences inherent to the nuclear. Only when these dimensions are considered together can we develop approaches that fulfil the obligation to assume responsibility beyond the 'living now' – towards the dead, the living and the not-yet-born.

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Competing interests:

The author declares that she has no conflict of interest.

Acknowledgments:

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