

Governing Post-Mining Risks: Expertise, Participation, and Knowledge Coproduction in French Post-mining Territories

By Baptiste Lebot*, Camille Dumat[‡] & Fenintsoa Andriamasinoro[°]

The cessation of mining activities has not eliminated associated nuisances such as pollution and land subsidence. In France, these risks are governed through highly centralized regulatory frameworks relying on standardized forms of scientific expertise. Based on a qualitative, multi-method study conducted in three post-mining territories, this article examines how legitimate knowledge is constructed, negotiated, and hierarchized in post-mining risk governance, and how these processes shape trust in public action. The analysis combines documentary review, interviews with institutional actors, elected officials, residents, and associations, and field observations. The findings show that post-mining governance is structured by an expert-centred epistemic regime grounded in regulatory compliance and technical indicators. While this model ensures legal and procedural coherence, it marginalizes experiential and place-based knowledge and constrains residents' capacity to influence decision-making. Participatory tools primarily operate as informational mechanisms, often generating frustration and mistrust. In response, inhabitants develop forms of "ordinary resilience" through everyday practices that sustain attachments to post-mining landscapes despite technical restrictions. The article argues that central challenge of post-mining governance lies not in participation per se, but in the institutional recognition of plural forms of knowledge, which is essential to enhancing trust and legitimacy in environmental risk management.

Keywords: Post-mining exploration Territories, risk, plural expertise, controversy, public action

Introduction

In France, the end of mining activities in the 1990s did not close the chapter of risks and nuisances associated with Post-Mining Extraction Territories (*Territoires Post-Extraction Minière*, TPEM). These territories remain exposed to persistent forms of environmental degradation, including soil and water pollution, the presence of metallic contaminants and mining waste, as well as land instability. Predominantly located in rural or peri-urban contexts, TPEM continue to bear the scars of a complex

*PhD Student, UTOPI (UMR 5311 CNRS-UT-UT2J-UPS), ADEME (French environmental agency), DPSM-BRGM (Post-mining division of French geological survey) & DYNAFOR (UMR 1201 INRAE-INP), France.

‡Professor, PhD Supervisor, DYNAFOR (UMR 1201 INRAE-INP) & UTOPI (UMR 5311 CNRS-UT-UT2J-UPS), France.

°Dr., PhD Supervisor, BRGM (French Geological Survey, Mineral Resources Division, Environmental and Social Assessment Unit), France. Dr., PhD Supervisor, BRGM (French Geological Survey, Mineral Resources Division, Environmental and Social Assessment Unit)

industrial legacy while facing renewed pressures related to land redevelopment and climate adaptation. They face a dual constraint: on one hand, managing the long-term impacts of historical mining activities on landscapes and soil quality, and on the other, reinventing economic, social, and environmental dynamics adapted to contemporary issues such as climate change and the preservation of ecosystems, biodiversity, and associated ecosystem services (Dumat, 2025; ZAN Act, 2023¹). Thus, TPME are at the heart of a dual challenge: 1) mitigating the long-term impacts of past mining activities; and 2) reconfiguring these spaces to meet the needs and expectations of contemporary populations, including such as urban agriculture projects (Jules & Dumat, 2022). Within this framework, the management of environmental and health risks emerges as a central concern, particularly regarding decisions that could affect public health (Mottis et al., 2022). Public authorities and experts often play a dominant role in these processes, while the voices of local residents, despite their close familiarity with local conditions and realities, are still scarcely considered. Through their engagement with these environments, residents possess situated empirical knowledge rooted in their daily practices (Mélard & Gramaglia, 2022). While often seen as subjective or anecdotal, this type of knowledge can play a valuable role in risk management, even though decision-making processes are not yet designed to fully equipped to integrate it (Ibid., 2022).

More broadly, this issue is framed within a context of increasing citizen demand for meaningful participation in democratic processes (Gourgue et al., 2021), especially in the realm of public action related to environmental issues (Lascoumes, 2018). Over the past two decades, political and legislative advancements have aimed to foster this process of integration. The declaration of rights (Aarhus Convention, 1998²; Environmental Code, 2000³) and the creation of institutional mechanisms (Local Information Committees (CLI), 2012; Site Monitoring Commissions, 2012)⁴ have been designed to integrate citizens into public action, encouraging participation in various ways and at different stages of decision-making processes. However, these meetings are sometimes perceived by citizens as a way to contain dissent (the famous “Participation, a trap for fools”, popularized in May 1968). Such forms of participation are often deemed “insufficient” or “instrumentalized” by citizens, leading to disenchantment and, in some cases, the emergence of counter-movements.

In TPME, deep tensions surrounding the management of environmental and health risks are observed (Busca & al., 2019), reflecting a growing need for “more democracy” in participation and posing a dual sociological challenge: on one hand, from the perspective of the residents, and on the other, from an institutional point of view. Accordingly, this article focuses on the management

¹Law No. 2023-630 of 20 July 2023 aimed at facilitating the implementation of objectives for combating land artificialization and strengthening support for local elected officials, Official Journal of the French Republic, 21 July 2023. Available at: <https://www.legifrance.gouv.fr/eli/loi/2023/7/20/TREX2306675L/jo/texte>

²United Nations Economic Commission for Europe (UNECE). (1998). Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention). Done at Aarhus, Denmark, on 25 June 1998. Available at: <https://unece.org/environment-policy/public-participation/aarhus-convention/introduction>

³French Environmental Code (Code de l'environnement). (2000). Consolidated version available at: <https://www.legifrance.gouv.fr/codes/id/LEGITEXT000006074220>

⁴See French Environmental Code, cited above.

of environmental and health risks in post-mining extraction territories, with particular on the role of plural forms of expertise in these processes. Adopting a pragmatic sociological perspective, it explores how institutional expertise, regulatory frameworks, and situated, experiential knowledge interact within post-mining governance arrangements. More specifically, the article addresses the following research questions:

- (RQ1) What processes shape, negotiate, and order legitimate knowledge in the management of environmental and health risks in post-mining areas?
- (RQ2) What are the consequences for trust in public action?
- (RQ3) Under which conditions certain knowledge claims are recognized as authoritative while others are marginalized?

The article sheds light on the epistemic and political dynamics that shape post-mining risk governance. It further examines emerging controversies in post-mining management and investigates how these dynamics influence both the production of environmental knowledge and the construction of sustainable trust – or persistent mistrust – between public authorities and local stakeholders.

Materials and Methods

Theoretical Background

Drawing on pragmatic sociology and Science and Technology Studies (STS), this research is based on a qualitative, multi-actor investigation that examines post-mining management as a situated and contested set of practices. Rather than approaching post-mining risks as predefined objects of regulation, the study analyzes how they are constituted through institutional arrangements, expert devices, public controversies, and lived experiences. This perspective makes it possible to account for the plurality of actors involved, the heterogeneity of knowledge forms mobilized, and the dynamic processes through which environmental and health risks are framed, debated, and governed in concrete situations.

To identify the range of actors involved in post-mining management and to analyze their differentiated perceptions of environmental and health risks, we adopt Dewey's (1927) conception of publics and Zask's (2008) interpretation of public formation. From this perspective, publics do not pre-exist matters of concern, but emerge through the experience of shared disturbances and the collective inquiry they generate. The post-mining "public" is understood here as the set of actors engaged – directly or indirectly – in the construction of post-mining risks as public problems, through processes of problematization, contestation, and negotiation (Cefaï, 1996).

Terminology

We approach knowledge co-production not as normative ideal, but as an empirically observable, describable, and measurable process. We define it as the joint involvement of institutional experts and non-institutional actors in at least one of the following stages: (1) problem framing (identifying of risks and priorities); (2) knowledge production (data collection, interpretation and/or contextualization); and (3) decision-oriented deliberation (discussion's analysis on management options or land-use planning scenarios). Co-production manifests empirically in practices such as incorporating residents' field observations into expert reports and establishing deliberative spaces for the joint interrogation of knowledge claims; and adapting technical interventions in response to section, which is organized into four thematic parts: (1) Institutional centralization and the standardization of post-mining risk management; (2) Local knowledge, everyday practices, and the contestation of expertise; (3) Participatory mechanisms and institutional's limits responsiveness; and (4) Emerging forms of knowledge co-production: conditions and constraints.

Within this framework, controversies are approached as specific forms of social interaction structured by argumentative and semantic disagreements among heterogeneous actors. Rather than being reduced to conflicts of opinion, controversies take the form of public trials in which competing definitions of problems, forms of knowledge, and normative frameworks are confronted and put to the test. They render visible the ordinary conditions of democratic functioning by raising questions of legitimacy – who is entitled to speak, on what grounds, and according to which procedures. Following a pragmatic sociological approach, the purpose is not to adjudicate these disputes, but to analyze the regimes of justification, critique, and proof mobilized by actors in order to stabilize or challenge claims (Boltanski & Thévenot, 1991; Barthe & al., 2013; Chateauraynaud, 2011). Finally, this process is nowadays qualified as reflexivity approach and valorized as good practice for young engineers in order to develop sustainable and robust technical solutions (Lehoux et al., 2019; Jacob & Magnani, 2024).

These controversies frequently reveal a gap between publicly articulated problems and institutional capacities to respond to them, a configuration that resonates with the notion of crisis. Crises are characterized by an escalation of complexity resulting from the coexistence of multiple and partially incompatible stakes – health-related, environmental, economic, legal, or symbolic – those standard instruments of public action struggle to articulate coherently. By putting established frameworks of expertise, decision-making, and responsibility to the test, crisis expose their limits and generate renewed forms of contestation. For the sociology of public action, such moments constitute privileged sites for observing the reconfiguration of responsibilities, the renegotiation of legitimate knowledge, and the transformation of coordination among actors (Cefaï & Terzi, 2012; Gilbert, 2014; Lagadec, 1991).

Risk constitutes another central analytical category of this study. Since major industrial disasters of the late twentieth century – such as Seveso (1976), Three Mile Island (1976), Bhopal (1984), and Chernobyl (1986) – trust in scientific expertise and public authorities has been widely challenged. In contrast to substantialist approaches that conceive risk as an objective and measurable reality (Beck, 2001,

1986; Giddens, 1991), constructivist and pragmatic perspectives emphasize its socially situated and processual character. Risk is understood as the outcome of processes of qualification, visibility, and prioritization carried out by actors endowed with differentiated experiences, interests, and forms of knowledge (Gilbert, 2003; Jasanoff, 2004; Peretti-Watel, 2001). Institutional experts and resident-citizens do not evaluate risks in the same way, as their perceptions are embedded in distinct social trajectories, value systems, and territorial attachments. Risk is therefore not merely calculated; it is debated, experienced, and managed through social interaction.

Finally, this study approaches knowledge co-production not as a normative ideal but as an empirically observable, describable, and assessable process. It is defined as the joint involvement of institutional experts and non-institutional actors in at least one of the following stages: (1) problem framing (identification of risks and priorities); (2) knowledge production (data collection, interpretation, or contextualization); and (3) decision-oriented deliberation (discussion of management options or land-use planning scenarios). Empirically, co-production is manifested through practices such as the incorporation of residents' observations into expert reports, the establishment of deliberative arenas enabling the mutual testing of knowledge claims, or the adaptation of technical interventions in response to local concerns (Callon et al, 1999; Chilvers & Kearnes, 2015; Jasanoff, 2004; Wynne, 1996). This analytical framework guides the empirical analysis presented in the following section, which is organized into four thematic parts: (1) institutional centralization and the standardization of post-mining risk management; (2) local knowledge, everyday practices, and the contestation of expertise; (3) participatory mechanisms and the limits of institutional responsiveness; and (4) emerging forms of knowledge co-production, their conditions, and constraints.

Literature Review

a) From latent risks to public problems: processes of environmental problematization

Public policy sociology has extensively demonstrated that public problems do not emerge naturally or self-evidently on political agendas, but are rather constituted through social processes of definition, selection, and public visibility (Cefaï, 1996; Hassenteufel, 2011). Environmental risks, in particular, become public problems through mobilizations, controversies, and competing framings that render certain situations visible and actionable, while others remain unrecognized or marginalized (Lascoumes, 1994; Lascoumes & Le Galès, 2005). These processes involve a wide range of heterogeneous actors – scientists, activists, residents, journalists, and public authorities – who interact within often unstable and conflictual configurations.

This is especially evident in the case of post-mining territories we explore, where the dynamic of public problematization of legacy pollution is marked by a high degree of complexity. Environmental nuisances in these contexts unfold over long temporalities, are often imperceptible – even invisible – and their health effects remain delayed, uncertain, and unevenly documented (Gramaglia, 2023; Wynne, 1993). It is sometimes through triggering events – such as media investigations, scientific publications, health alerts, or local mobilizations – that these latent risks acquire

public visibility and prompt forms of institutional recognition or intervention. In these processes, figures such as “whistleblowers” (Chateauraynaud & Torny, 1999) sometimes play a decisive role by transforming hidden or underestimated risks into publicly acknowledged problems.

b) Perceiving and governing environmental risk in post-mining contexts

The public problematization of environmental risks is closely intertwined with broader transformations in risk governance. As emphasized by Giddens (2000) and Borraz (2008), environmental risk management constitutes a central political issue in contemporary societies, insofar as it entails decision-making under conditions of uncertainty and involves delicate trade-offs between economic imperatives, public health protection, and citizen aspirations. In TPÉM, this situation is sometimes aggravated by the absence of robust epidemiological data on long-term impacts, which leaves public authorities with a margin of discretion that is often perceived as enabling the minimization of dangers or the postponement of corrective measures. These situations resonate with the core insights of risk society theory (Beck, 2001, [1986]; Douglas & Wildavsky, 1982), which emphasize the politicization of risk in modern societies, particularly when uncertainties challenge institutional authority and expertise.

In line with the foundational work of Ulrich Beck (2001 [1986]) on the “risk society”, several studies have shown that contemporary environmental risks are characterized by their diffuse, often invisible, and uncertain nature, often eluding traditional regulatory instruments (Crivellari, 2024). Persistent metallic pollution and soil instability on former mining sites exemplify this so-called modernity of risks, whose medium and long-term consequences remain uncertain not only for local populations but also for experts themselves. The sociology of risk perception has also highlighted the diversity of social relationships to danger and the existence of social inequalities in exposure and in capacities for protection social (Peretti-Watel, 2001; Le Breton, 2002; Slovic, 2000). The recent work of Busca et al. (2023) in the Orbiel Valley provides an empirical illustration of these dynamics: residents develop situated and experiential forms of knowledge, as well as specific perceptions of danger, based on their daily experiences, spatial practices, and territorial memories. These ordinary knowledge and perceptions, often disqualified by health authorities or state technical services, are constructed through empirical observations, shared narratives, and a sensory and affective relationship to degraded environments. Moreover, residents wish to regain autonomy and the ability to act within their territory.

c) Post-mining territories as contested socio-technical laboratories

This marginalization of ordinary knowledge within institutional risk management frameworks has significant consequences. It fuels distrust toward public authorities and exacerbates controversies surrounding environmental policies, land-use regulations, and monitoring systems. As emphasized in various works, the public management of environmental risks is marked by structural tensions between technical rationality and social legitimacy (Beck, 2001 [1986]; Borraz, 2008; Crivellari, 2024; Gilbert, 2003; Jasanoff, 2004). In TPÉM, these tensions are further intensified by the uncertainty surrounding the nature and extent of pollution, making it difficult to establish

indisputable evidence and clearly allocate responsibilities. This situation intensifies conflicts between existing land's uses (agriculture, urban development, gardening) and environmental and health monitoring systems.

Post-mining territories thus emerge as contested socio-technical spaces where multiple actors – residents, associations, experts, local elected officials, and public authorities – engaged in struggle over problem definitions, responsibility allocation, and future land uses (Callon, Lascoumes & Barthe, 2001; Chateauraynaud, 2011). TPEM provide an especially salient setting for these confrontations, particularly around the management of mining residues, site security, and the future use of land (Mottis et al., 2022). Although experts and public institutions retain a relative monopoly over practices (what is, or not, legitimate), local mobilizations increasingly produce alternative forms of knowledge that challenge dominant expertise (Gramaglia, 2023; Busca & al., 2023; Ottinger & Cohen, 2011). Resident practices of reinvesting in wastelands and reclaiming collective memories have thus become both political and symbolic stakes, revealing not only environmental but also social and identity-based dimensions of conflict.

The work of Jules and Dumat (2022) on urban community gardens in Toulouse illustrates how citizen initiatives can simultaneously address social and environmental needs, while confronting rigid institutional systems reluctant to recognize the value of these non-institutional and informal uses of degraded spaces. TPEM's controversies are more shaped on risk's definition than the recognition of local uses and memories, within a context where territorial reconversion encounters the imperatives of land-use sobriety and ecological preservation (ZAN law, 2023). Similar dynamics have been documented in international research on post-industrial and contaminated landscapes, highlighting the transnational dimension of these socio-environmental conflicts (Mah, 2012; De Sousa, 2006).

Recent studies suggest, however, that greater consideration of residents' perceptions and collective memories not only contribute to restoring trust but also enables the construction of context-sensitive and socially acceptable solutions (Busca et al., 2023; Bonincontro, 2024). These dynamics are part of a broader citizen demand for a renewed environmental democracy, capable of recognizing the plurality of forms of knowledge and the social uses of territories. The recent sociological literature on TPEM in France thus shows that these spaces function as complex social laboratories where issues of risk management, territorial reconversion, and citizen participation intersect. It also highlights that the recognition of situated knowledge, the co-construction of problem definitions, and the expansion of deliberative spaces appear as necessary conditions for the elaboration of adapted and legitimate environmental policies. This resonates with global calls for epistemic justice and inclusive governance in environmental decision-making (Fricker, 2007; Jasanoff & Martello, 2004).

Data Collection Method

The analysis draws on a qualitative, multi-method research design aimed at capturing the social and institutional dynamics of post-mining risk governance through the collection of actors' discourses and practices.

Data collection combined documentary analysis, interviews, participant observation, and experimental participatory tools.

The first phase consisted of an extensive documentary review aimed at situating the territorial issues and institutional arrangements of post-mining management. This included the analysis of reports produced by institutions in charge of post-mining management, such as 'health and environmental risk management organizations'⁵, in order to examine institutional framings, priorities, and decision-making rationales. Academic literature on risk, expertise, participation, and controversy was also reviewed to inform the analytical framework. In addition, local media sources (newspapers, blogs, websites) were examined to document public controversies and local problem definitions. This phase provided a preliminary mapping of actors and power relations and informed subsequent fieldwork.

The second phase involved qualitative interviews (Blanchet & Gotman, 2015), combining semi-structured interviews with institutional and associative actors and informal, unstructured conversations conducted during field encounters. This approach enabled the collection of more detailed narratives while allowing for a certain degree of flexibility to explore topics deemed relevant by the interviewees themselves (Bertaux, 2010). Interviewees were recruited through institutional contacts, local associations relying on snowball sampling: leading to recruit actors via recommendations. The recruitment of participants relied both on institutional contacts, linked to the framework of the institutional commission, and on outreach efforts directed at local associations and residents of the post-mining territories under study. This approach was complemented by the use of snowball sampling, which enabled the identification of additional participants through referrals. This strategy aimed to assemble a diversified sample encompassing different categories of actors – state representatives, public operators, elected officials, association members, residents, and landowners – and was particularly suited to a context characterized by dense local networks, fragile relations of trust, and, at times, open controversies.

We encountered four types of actors – as illustrated in *Table 1*. presenting also codes used in order to preserve the private information.

1) Institutional actors (deconcentrated state services and specialized agencies) were interviewed due to their central role in France for the production, implementation, and interpretation of the regulatory framework governing contaminated sites and soils. As key actors of environmental expertise, they contribute to the definition of norms, procedures, and risk categories, as well as to the technical and administrative monitoring of contaminated sites. Their accounts make it possible to analyze the concrete modalities of environmental governance, decision-making processes,

⁵These organizations are the French Geological Survey and (BRGM) and the French National Institute for Industrial Environment and Risks (INERIS).

and the tensions between regulatory prescriptions, operational constraints, and scientific uncertainties.

2) Local elected officials were interviewed as mediating actors between regulatory requirements, residents' expectations, and territorial development objectives. Their inclusion is justified by their distinctive position at the intersection of political, administrative, and symbolic registers of action. They are involved in the management of contaminated sites through arbitration processes related to land-use planning, brownfield redevelopment, public health protection, and public communication. Their narratives allow for an examination of how environmental issues are politicized, translated into public problems, and integrated—or not—into territorial development projects.

3) Residents living in the affected territories were interviewed in order to document everyday experiences of pollution, risk perceptions, and situated forms of knowledge emerging from prolonged exposure to degraded environments. Their perspectives are essential for understanding how expert-based management and regulatory tools are received, contested, or appropriated in daily life. These interviews also shed light on the social, health-related, and symbolic effects of pollution on residential trajectories, spatial practices, and relationships with public institutions, highlighting discrepancies between expert risk assessments and lived experiences.

4) Finally, local and national associations, along with their representatives, were interviewed as collective actors playing a structuring role in the public visibility of pollution and in the circulation of controversies. They were selected for their functions as spokespersons, producers of counter-expertise, and intermediaries between residents, experts, and public authorities. Analyzing their practices makes it possible to examine mobilization dynamics, evidentiary strategies, and forms of both critique and cooperation with institutions. These actors actively contribute to the redefinition of public problems related to contaminated sites and soils.

Table 1. *Characteristics of Interview Participants and Reference Numbers used in Citations (Lebot, 2026)*

Status	Role	Interview reference code
Institutional actors	Regulatory and expert authorities responsible for defining, implementing, and monitoring contaminated sites and soils governance	Z
Local elected officials	Political and territorial mediators involved in decision-making, land-use planning, and public communication	E
Local residents	Inhabitants experiencing pollution in everyday life; providers of situated knowledge and risk perceptions	H
Associations and representatives	Collective actors engaged in mobilization, counter-expertise, and mediation between residents, experts, and public authorities	A

To capture non-verbal and interactional dimensions, direct observations were conducted during site visits, public meetings, and inspections (Arborio & Fournier,

2005). These field observations made it possible to document the dynamics of interactions between actors and their environment, and to understand how knowledge is exchanged or ignored. They also provided an opportunity to observe the power mechanisms underlying participatory processes, including tensions between experts and local residents, such as the forms of resistance developed against governance models perceived as disconnected from their everyday concerns.

Data Analysis Method

All interviews were fully transcribed and analyzed using iterative thematic coding, combining deductive categories from the literature (expertise, trust, participation, co-production) with inductive categories emerging from the data.

The researchers' positionality – at the interface of institutional research mandates and an academic sociological agenda – was reflexively considered throughout the study. The commissioning framework, aimed producing operational knowledge for management institutions, influenced field access and expectations regarding outcomes. During fieldwork, the research relationship was marked by the perception of the researchers as institutional interlocutors, a positioning likely to elicit strategic or normative discourses from local actors; this effect was addressed by explicitly distancing the researchers from the institutions involved.

To uphold a sociological perspective, the researchers situated issues of territorial reconversion, governance, and environmental and social remediation within their broader socio-political contexts, taking considering power relations, regulatory constraints, and local memories associated with mining activity.

The research followed established ethical standards: all participants provided informed consent, interviews were anonymized, and transcripts remain confidential.

Case-study: Three post-mining Territories

The three former mining territories investigated were selected on the basis of a proposal by the management of the Mining Risk Prevention and Safety Department (*Département Prévention et Sécurité Minière*, DPSM) of the BRGM. The selection relied on a combination of institutional, technical, and socio-political criteria.

All three sites are classified as “post-mining” areas (*après-mine*), as they include former mining concessions that have been relinquished or renounced and – in accordance with the French Mining Code – correspond to extractive activities precede to 1810. In addition, each territory has been subject to ongoing or recently completed public interventions led by state agencies or their operators, aimed at preventing or managing risks inherited from past mining activities. From the perspective of post-mining practitioners, these territories present contrasting management situations, both in terms of the advancement of technical measures and the nature of relationships between institutions and local stakeholders. Interventions are perceived as either completed or ongoing, and as having unfolded in a relatively consensual or, conversely, conflictual manner. This diversity of socio-institutional configurations was deliberately sought as a methodological asset, enabling a comparative analysis of post-mining governance arrangements and their associated local dynamics.

Results

1. Institutionalization and centralization of post-mining risk management

An examination of interviews⁶ and administrative archives reveals that the TPÉM's governance in mainland France became increasingly institutionalized from the 2000s onward, shaped by a combination of European obligations, national standards, and local imperatives for spatial structuring.

In response to environmental disasters in the Lorraine iron-ore mining basin (1996-1999), public authorities initiated a collective reflection by creating the expert body GEODERIS (the Group of Experts from BRGM and INERIS, 1998-2001) to define and disseminate a standardized national methodology.

The 2006 Extractive Waste Directive (Directive 2006/21/EC⁷) marked a decisive turning point: France adopted⁸ a regulatory framework mandating a formalized management of mining residues, extending beyond the physical risks of subsidence or collapse to encompass metallic and metalloid pollution, newly recognized as major environmental hazards. A special department – the DPSM (2006) – was created at the BRGM to secure and monitor mining damage (Figure 1). This formalization is part of a broader, incomplete process of politicizing the French subsurface, largely dominated by centralized technocratic logics (Arnauld de Sartre & Chailleux, 2021; Arnauld de Sartre & Chailleux, 2026).

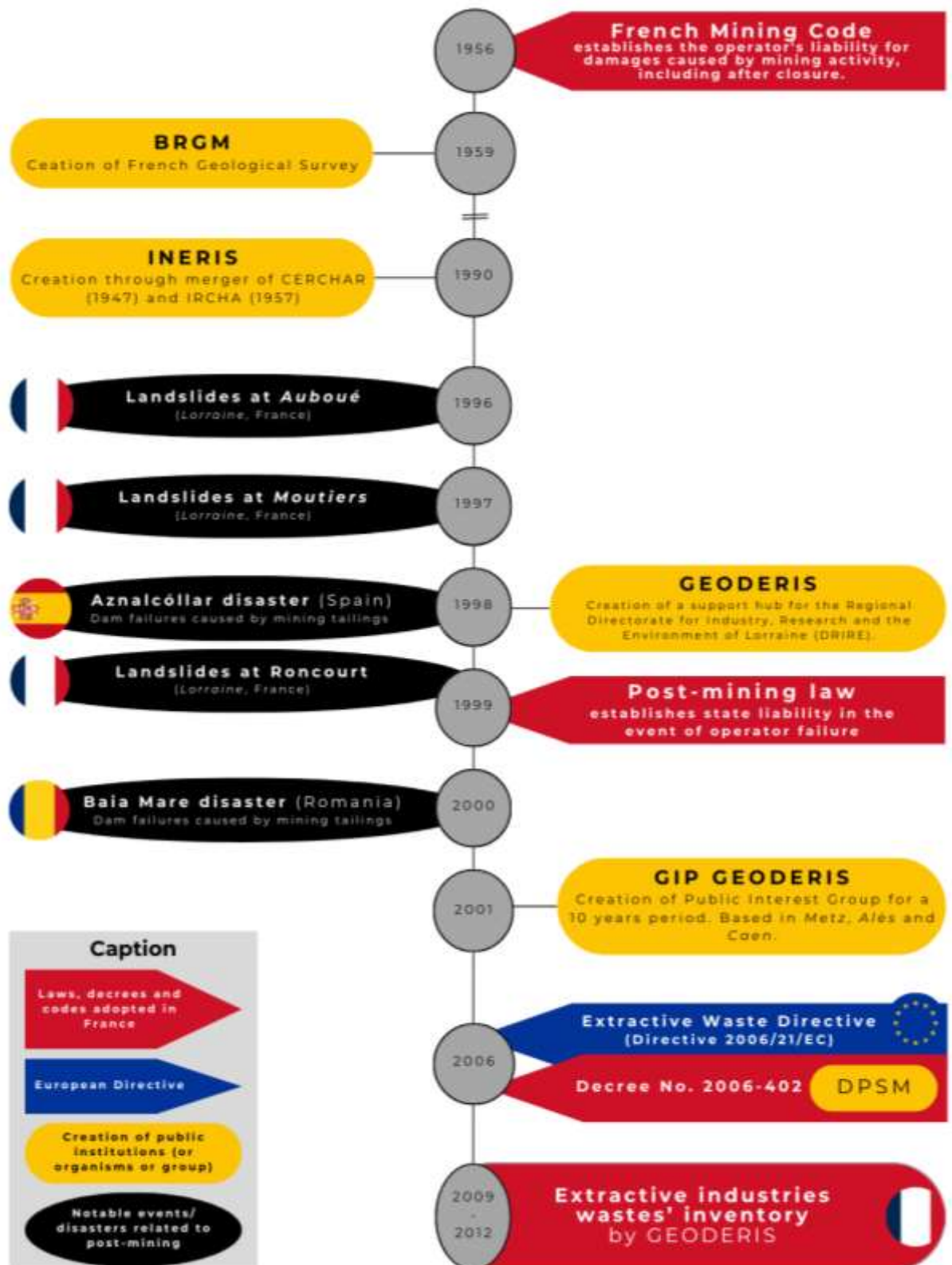
Figure 1 provides a synthetic representation of the governance timeline of post-mining regulation in France. It presents the progressive institutionalization of management bodies (BRGM, INERIS, GEODERIS, DPSM), their embedding within national (French Mining Code, Post-mining law) and European (Extractive Waste Directive) legal frameworks, and the structuring role of disasters in placing post-mining issues on the public agenda and in the gradual formalization of concerns related to mining legacies and risks.

⁶In total, 9 interviews were conducted with agent from health and environmental risk management organization (Institutional actors, Z in *Figure 1*). 38 interviews were conducted across three post-mining sites (with Local elected official (E), local residents (H) and associations (A)).

⁷Directive 2006/21/EC - <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32006L0021>

⁸Decree No. 2006-402 of April 4, 2006 amending Decree No. 59-1205 of October 23, 1959 relating to the administrative and financial organization of the BRGM and laying down transitional provisions relating to Charbonnages de France. <https://www.legifrance.gouv.fr/loda/id/JORFTEXT000000607316>

Figure 1. Governance Timeline of Post-mining Regulation in France (Lebot, 2026)



The methodology established by this framework prescribes a three-phase approach: First, identification of physical and chemical risks through quantitative soil and water analyses; Second, implementation of safety measures (including shafts sealing, waste containment, and source-level pollution control); and third post-intervention environmental monitoring to verify regulatory thresholds and sampling rate. This centralized approach ensures strong cohesion in practices nationwide, it simultaneously generates a top-down governance model in which strategic decisions are made at the center and implemented uniformly across affected territories. While this formalization has undeniably produced positive outcomes — clearer allocation of responsibilities, standardized procedures, legal security for public action, and traceability of interventions — it also reinforces a technocratic rationality in which the territory is primarily perceived as an object to be secured according to scientific and administrative criteria, at the expense of the social, historical, or symbolic dimensions associated with the post-mining landscape. Consequently, centralized decision-making frequently overrides localized and nuanced approaches, creating a symbolic distance between the expert state and local populations, as subsequent sections will demonstrate.

In the absence of effective mechanisms for integrating residents' situated knowledge, many testimonies express frustration: "What we ask is that, before they decide to cover up [the mining remnants], they look into whether other treatment options exist. There are plants capable of absorbing heavy metals... but here, everything has been removed, nothing remains visible. So perhaps one should reflect on the method before ending up in a meeting where we hear, 'See how well we handled it.' Well, no!" pleads one resident (H14), demanding that traditional methods or local knowledge be considered before major interventions. Regional Directorates for the Environment, Development, and Housing (DREAL) act as intermediaries between management agencies and prefectures. Beyond information dissemination, participatory mechanisms are considered time-consuming and incompatible with already saturated institutional agendas, compounded by the perception that this would fall outside their official remit: "Listen, I didn't have time. If a meeting goes badly and it backfires on me, I had other priorities," explains Z9. It illustrates a unilateral communication style that transforms these public meetings into formal exercises devoid of real opportunities for feedback integration – for example, in the formulation of political decisions.

2. *Fragmented governance and procedural participation*

Despite the technocratic dominance described above, post-mining governance in France is not devoid of participatory arrangements. It relies on a set of formal instruments for information and consultation, including Local Information Commissions (CLIs), Site Monitoring Committees (CSS), public meetings, public inquiries, and complaint registers. These devices are intended to structure the circulation of information between state agencies, local elected officials, and residents. Interview data indicate that responsibilities for communication are distributed across several institutional levels, with specific roles attributed to each.

Several respondents identify the Regional Directorate for the Environment (DREAL) and the prefecture as the primary institutional authorities responsible

for communication. As one interviewee put it, “For me it’s more DREAL and the prefecture who are responsible for communication” (Z3). At the same time, state agents describe communication as being partially delegated to mayors: “DREAL doesn’t have time to do that. And anyway, it’s up to the mayor to communicate. The head of DREAL is the Prefect, so if a meeting goes badly, it falls directly on state agents” (Z9).

According to this same actor, information produced by DREAL is transmitted to local elected officials: “Information from DREAL stops at the mayors. After that, it’s up to the mayors to decide if a public meeting is necessary. And when they are organized, nobody comes!” (Z9). In this configuration, mayors are described as the main interface between state services and residents, particularly when it comes to organizing meetings and relaying information at the local level.

Interviews also show that communication follows a strictly hierarchical institutional structure. Several state agents referred to constraints on initiative and on the circulation of information outside formal channels: “If we have the misfortune to bypass the chain of command, we get yelled at!” (Z7). This indicates that exchanges between institutions and residents are expected to pass through predefined administrative pathways.

At the same time, some field agents articulated a positive view of citizen involvement: “It seems very healthy to me that citizens ask to see what’s going on in their own territory... The idea is not to abandon people who live in these areas. If there is pollution, they must be supported” (Z6). These statements coexist with accounts emphasizing time constraints, administrative priorities, and the management of institutional risk within state services.

Taken together, the interviews document a system in which communication and participation are formally organized through multiple instruments and distributed across several levels of authority, from the prefecture and DREAL to municipal governments. They also show that responsibility for informing and involving residents is shared between these actors, with information circulating through hierarchical channels and being relayed locally by mayors via meetings or other communication devices. One respondent emphasized that the timing and uneven distribution of information shape the form of exchanges: “If people don’t have the same level of information, they can’t have a discussion. The problem is that public meetings come too late. So, when discussions do happen, they’re usually in ‘opposition’ mode, in conflict” (Z13).

3. *Marginalization of experiential and local knowledge*

Residents and local associations sometimes report difficulties in having their observations, proposals, and alternative solutions considered. Experiential knowledge – derived from long-term residence, sensory perception, and everyday practices – was rarely translated into institutional categories recognized as legitimate evidence.

Institutional actors tended to treat local knowledge as anecdotal or emotionally driven, particularly when it contradicted official measurements: “They speak from experience... they’re not dead” (Z9), reveals a symbolic downplaying of lived experience and a clear distinction between local observations (the absence of illness among residents) and official expertise (acknowledging significant heavy metal levels as risks to human and environmental health).

This asymmetry was reinforced by time constraints and administrative priorities. As one state agent admitted, participatory engagement was often considered incompatible with institutional workloads and risk management responsibilities.

Across the three sites, interviews reveal that inhabitants maintain strong affective, historical, and identity-based relationships with post-mining landscapes. These attachments frequently conflict with technical framings that define the same spaces primarily as hazardous or degraded.

Residents continue to use former mining sites for walking, gardening, or informal social activities, even when official restrictions apply. One elected official recalled: “I played here as a kid... everyone did.” In contrast, institutional discourse tends to focus on exposure thresholds and sanitary risk.

This divergence produces a persistent trust gap between public authorities and local populations. Residents interpret institutional interventions as imposed, opaque, and disconnected from lived reality, while experts perceive local practices as potentially unsafe or irrational.

Rather than open confrontation, this mismatch often results in what can be described as “ordinary resilience”: inhabitants quietly maintain their uses and attachments despite regulatory constraints, while institutions continue to apply standardized technical solutions.

Discussions

Interpretations

The analysis of TPEM reveals the persistence of a top-down environmental governance model, in which public agencies produce knowledge according to technical and regulatory frameworks that often fail to capture local perceptions and practices. Environmental and health crises, however, highlight the need for more inclusive, territorially grounded governance. Integrating diverse actors in the governance can enhance policy legitimacy, improve diagnostic quality, and reduce social tensions by acknowledging conflicting collective memories and situated experiences.

a) Reframing post-mining risk governance as an epistemic regime

The results show that post-mining risk management in France is not only a regulatory or technical system, but a structured epistemic regime that defines what counts as valid knowledge, who is authorized to speak, and which realities become governable. The institutionalization of GEODERIS, the DPSM and standardized national methodologies has produced a powerful infrastructure of knowledge production, in which environmental risk is translated into indicators, thresholds, and procedural formats.

This finding refines Beck’s “risk society” thesis by showing that the politicization of risk in post-mining territories is not driven only by uncertainty, but by the mismatch between institutionalized ways of knowing and lived ways of experiencing danger. The expert-centered model produces social, cognitive, symbolic, and political effects through the distance it establishes between technical knowledge and empirical

lived experience. The expertise mobilized by management agencies operates within a framework combining scientific knowledge and a normative posture: supervising pollution and geological risk monitoring through standardized indicators and producing formal technical reports according to legal deadlines. This expert-driven process – legitimized by regulatory standards and instrumental rationality (Weber, 1978) – relies on three essential levers: technical mastery of pollution control, centralized financial management (through nationally and regionally targeted budgets) and compliance with regulatory requirements, which underpin credibility in the eyes of public funders. Technical transparency (reports, documents, thresholds) functions as a corollary, intended to strengthen institutional legitimacy. Yet this model presents clear limitations: it tends to narrow alternatives to context-sensitive or innovative solutions, favoring normative rigor and frequently excluding spontaneous local initiatives. While the centralization of expertise effectively imposes a unified strategy, it remains ill-suited to the specific constraints of territories or citizen mobilizations. By constructing legitimacy solely on technical grounds, institutional actors shape a relationship to risk in which local knowledge — based on empirical observations, use-related narratives, and social memory — is largely disregarded, particularly when it does not align with official indicators. This imbalance between technical rationality and social perception fosters mistrust among local actors, whether elected officials or residents, and raises the issue of the compatibility between centralized expertise and locally co-constructed projects.

The reflections of Bessy and Chateauraynaud (1995) on the figures of the expert and the impostor, offer a valuable conceptual framework for analyzing the tensions surrounding the production and credibility of environmental expertise. The authors emphasize that expertise is never fully stabilized, but constantly exposed to public tests of credibility, during which external actors – residents, activists, elected officials – may contest, reinterpret, or replay the technical assessments produced by institutions. In the context of post-mining territories, this dynamic manifests in controversies over risk assessment methods, regulatory thresholds, and intervention priorities. These public tests are not solely matters of political contestation, but also instances of a “sociology of perception” (Bessy & Chateauraynaud, 1995), in which social representations of danger, territory, and industrial history actively dispute the official expertise’s claim to objectively describe reality. This observation also echoes Sheila Jasanoff’s (2004) work on “civic epistemologies” in risk governance, which demonstrates that the credibility of technoscientific knowledge is closely tied to the social, historical, and political contexts in which it circulates. Applied to French post-mining territories, this invites us to conceive of expertise arrangements not as closed, self-contained systems, but as contested arenas where the contours of public problems and legitimate solutions are continuously negotiated.

In post-mining territories, legitimate knowledge is primarily produced through the progressive institutionalization of risk management, structured by European and national regulatory frameworks (RQ1). The establishment of expert bodies (GEODERIS, the DPSM within the BRGM) and the diffusion of standardized methodologies have consolidated a knowledge regime grounded in scientific expertise, risk quantification, and regulatory compliance. Legitimacy rests on objectified indicators - pollution thresholds, physico-chemical analyses, and technical reporting - produced by central actors and deployed through top-down decision-making. This configuration severely

constrains knowledge negotiation: complex administrative arrangements and saturated institutional agendas leave little room for deliberation or co-production with local actors. As a result, experiential and place-based knowledge is systematically subordinated, as it fails to conform to administratively recognized normative formats.

b) From participation to epistemic asymmetry: Trust and knowledge

Although multiple participatory devices exist (CLIs, CSS, public meetings), the results show that they operate mainly as procedural interfaces rather than epistemic spaces. They organize the circulation of already-produced knowledge but rarely allow residents to participate in the definition of problems, priorities, or acceptable trade-offs.

This pattern is rooted in a long history of top-down governance, in which institutional interlocutors restrict citizen involvement to non-deliberative public information meetings, effectively stripping local actors of any concrete participatory capacity (H14). As a result, participation is formally present but substantively weak, a dynamic that empirically confirms what Blondiaux and Sintomer (2002) have described as the “participation trap”. The core deficit is not communicative but epistemic: citizens may be informed, yet their situated knowledge rarely acquires the capacity to shape decision trajectories.

This is crucial: controversies are not simply conflicts of opinion, but tests of legitimacy between competing regimes of knowledge (Boltanski & Thévenot, 1991; Chateauraynaud, 2011). In the post-mining territories studied here, these trials are structurally unequal. Institutional expertise enters public arenas already stabilized by regulatory frameworks, budgetary constraints, and technical protocols, whereas residents’ knowledge remains localized, fragile, and readily dismissed as anecdotal or subjective.

Insights from Akrich, Barthe, and Rémy’s (2010) work on dynamics of lay mobilizations in response to health and environmental threats help to illuminate this configuration. Their analysis demonstrates how “ordinary” or situated knowledge becomes a critical epistemic resource precisely when institutional actors struggle to produce consensus. In post-mining territories, lay mobilizations extend beyond protest and are embedded in everyday practices of environmental vigilance, risk monitoring, and experiential interpretation of degraded landscapes. Residents and grassroots associations thus position themselves as whistleblowers (Bessy & Chateauraynaud, 1995) and, in some cases, as de facto co-producers of environmental knowledge, challenging the monopolization of epistemic authority by centralized expertise.

The trust deficit observed in all three territories does not primarily stem from hostility toward science or institutions. Rather, it emerges when people cannot recognize their own experiences in the official representations of risk. Residents’ attachments to post-mining landscapes – memories, daily uses, emotional bonds – are not merely cultural residues; they are forms of situated knowledge about exposure, habitability, and environmental change. When these are ignored or dismissed, institutional action becomes socially unintelligible, even if it is technically justified. The persistence of “ordinary resilience” – continued informal uses of contaminated spaces – can thus be interpreted as a practical critique of technocratic governance, rather than as mere risk-taking behavior.

Trust, in this sense, is not a psychological variable but a cognitive and political one: it depends on whether people can understand how decisions are made and see

how their own realities are considered. This analysis resonates with Wynne's (2013) seminal work on science and lay publics, which demonstrated – through the case of radioactive contamination in Cumbria – that local knowledge can serve as a valuable resource for refining and contextualizing scientific expertise, provided it is acknowledged and integrated into governance frameworks. In French post-mining territories, the absence of enduring mechanisms to recognize these forms of citizen knowledge tends to ossify roles and reproduce asymmetries of legitimacy, thereby limiting the capacity of affected populations to influence decisions impacting their living environment.

The consequences of this epistemic exclusion are both symbolic and political. Symbolically, post-mining sites tend to be framed primarily as objects to be corrected, secured, or remediated, rather than as lived environments whose collective memories contribute to local identity and territorial narratives (Halbwachs, 1992). Politically, ordinary resilience manifests in informal practices – the use of wastelands, communal gardens, or heritage uses of the site – that often exist in tension with official norms (Busca et al., 2023). These practices reveal residents' capacity to maintain a relationship to place that resists technocratic-administrative logic. They represent both passive forms of contestation and markers of situated, historical, and empirically grounded knowledge that refuse the symbolic erasure of industrial traces.

From this perspective, ordinary resilience should not be interpreted merely as risk-taking or regulatory non-compliance. The tensions between technical legitimacy (institutional expertise) and social legitimacy (local experiences and symbolic practices) expose a structural fault line in the governance of post-mining territories. They underscore the need for an epistemological and political adjustment: for public action to be both legitimate and effective, it must integrate plural expertise capable of reconciling technical knowledge with lived experience (Fischer, 2000).

Ultimately, the central problem is not the absence of participatory arrangements but the persistence of epistemic asymmetry that undermines trust in public action (RQ2). While technocratic governance strengthens legal certainty and procedural standardization, it also produces symbolic distance between institutions and affected populations. Decisions are widely perceived as opaque, imposed, and disconnected from everyday life, particularly when local observations and territorial attachments are subordinated to abstract scientific criteria. Participatory tools, when they exist, remain largely informational and consultative, thereby reinforcing perceptions of exclusion. The resulting dissonance between institutional discourse and lived experience sustains a persistent trust deficit, manifested in frustration, mistrust, and the ongoing practices of ordinary resilience through which inhabitants continue to inhabit, reinterpret, and contest post-mining landscapes despite technical and regulatory constraints.

c) Knowledge co-production forms potential

Accordingly, some territories have begun experimenting with emerging forms of governance and knowledge co-production (*Prior* (Busca et al., 2023); *Eco-citizen Institutes*⁹), illustrating possibilities for distributed expertise (Callon et al., 2001; Chilvers & Kearnes, 2015). In practice, it sometimes occurs that elected officials, residents, and

⁹<https://www.iecsea.org/>

associations succeed in asserting their empirical observations and/or proposing alternative solutions, landscape valorization or preservation of industrial remnants for memorial or tourism purposes. Such compromises require dual conditions: they must be both socially acceptable and, above all, safe from a public health perspective.

These initiatives often function in an ad hoc, dependent fashion, shaped by local or individual goodwill and the presence of actors open to co-construction. Nonetheless, they demonstrate significant potential benefits: improving institutional trust, enhancing project acceptability, reducing conflict, and producing more precise and contextually grounded diagnoses. Yet these initiatives remain a minority and heavily dependent on organizational conditions: the absence of sustainable institutional procedures, rigid administrative hierarchies, and structural constraints. They illustrate the potential for renewing governance models, while also showing that transforming the expert-centric model would require structural reforms: notably the formal inclusion of citizen knowledge in evaluation processes, training officials in territorial listening, and establishing intermediary deliberative mechanisms endowed with real decision-making power (Blondiaux, 2008; Fung, 2006).

Moreover, the ambition to make this data accessible to lay audiences frequently results in the excessive simplification of scientific knowledge. While popularization is necessary from a democratic participation perspective, it is not without consequences for the nature of the knowledge conveyed. Reducing uncertainties, selecting certain results while omitting others deemed overly technical or anxiety-inducing, and a tendency to produce simplified messages can distort the complexity of the studied phenomena. Such simplification risks concealing internal scientific controversies, methodological limitations, or persistent uncertainties — all essential to a rigorous understanding of environmentally and health-sensitive situations.

Furthermore, this dual process of full public disclosure and excessive simplification risks weakening the legitimacy of expertise by exposing it to criticism based on misunderstandings or ‘dangerous’ expectations (from a health or environmental perspective). It may also deepen asymmetries between different knowledge registers. If scientific knowledge is simplified for the sake of intelligibility, while empirically situated knowledge struggles to be granted epistemic legitimacy, participatory mechanisms risk perpetuating implicit hierarchies rather than fostering genuine dialogue between knowledge systems. These issues therefore invite reflection on the conditions of knowledge production, dissemination, and debate in health-environment arenas. The challenge is not to limit access to information, but to design mediation and translation mechanisms capable of preserving scientific rigor while enabling critical appropriation by heterogeneous publics.

The attribution of epistemic authority (RQ3) is contingent upon alignment with dominant institutional frameworks and the positional power of the actors involved. Knowledge produced by expert agencies, central administrations, or institutionally embedded actors benefits from strong legitimacy, as it is framed within a regulatory conception of the collective good and public safety. Conversely, knowledge articulated by residents, local associations, or grassroots elected officials is marginalized when perceived as overly situated, affective, or individualized—particularly when it cannot be translated into standardized indicators. This filtering process privileges conformity to expert discourse over contextual relevance, rendering invisible forms of knowledge

that are nonetheless critical to a socially grounded understanding of post-mining territories.

Limits

Nonetheless, this integration faces limits. Full release or oversimplification of technical reports can undermine understanding and credibility. Participatory processes may fall into a “participation trap” (Blondiaux & Sintomer, 2002), where deliberation is largely informational, and residents’ empirical proposals are excluded, reinforcing mistrust. These challenges illustrate the difficulty of reconciling institutional expectations with pragmatic engagement of local knowledge.

While this study highlights the fragility and unevenness of knowledge co-production in post-mining territories, it is limited by various aspects. This commissioned study was initially designed to address institutional questions and expectations, which may have influenced the formulation of sociological questions, the selection of participants, and ultimately the interpretation of the results, thereby reflecting, at least in part, the institution’s priorities. From a practical and methodological perspective, time constraints and the study’s affiliation with administrative bodies contributed to limiting the sample size. The sample could have been broader, for instance by including other TP EM beyond those selected by the commissioning institution, thereby enabling the exploration of territories with potentially different issues that were not anticipated by the institution. Finally, ethical considerations should be highlighted: the funding of the study or the dissemination of its results could be mobilized by the institution to strengthen its legitimacy in areas extending beyond the strict domain of the social sciences and humanities, thus conferring a form of scientific endorsement to the research. Future research could support the management process to observe and act as a mediator between the different actors of TP EM regarding the governance of health-environmental risks.

At the same time, this research also highlights important limitations to reach full co-construction or collective experimentation. While Serious Games appear to be promising mediation and learning tools, the results suggest that promoting an exploratory game to a general citizen audience may be premature. For non-expert publics, the cognitive and informational burden—particularly in complex post-mining contexts—can limit appropriation and meaningful engagement. In contrast, institutional actors or professionals involved in post-mining management may constitute a more appropriate initial target audience, as they already possess baseline knowledge of the actor landscape and regulatory framework.

Recommendations

The analysis of the TP EM case confirms the persistence of a predominantly top-down model of environmental governance, in which public agencies produce and legitimize knowledge through technical and regulatory frameworks. It also reveals the risks and tensions entailed by such openness, particularly concerning the public dissemination and popularization of scientific knowledge. These issues constitute major challenges for implementing truly participatory health-environment governance,

which warrant further clarification. First, the unrestricted public release of technical reports produced by expert bodies raises important questions. While the transparency of public information has become a core principle of environmental policy, the unmediated dissemination of highly specialized documents presents several risks, as they are based on complex methodological protocols and technical concepts often inaccessible to non-specialist audiences. Their raw availability may lead to misunderstandings or unfounded anxieties. In the absence of mechanisms for shared interpretation or socio-technical translation (Callon et al., 1999; Nowotny et al., 2001), such documents risk being appropriated polemically by some actors, fueling public controversies more rooted in partial perceptions than in consolidated analyses. This is particularly sensitive in contexts of environmental and health crises, where public demand for information is often accompanied by distrust toward expert institutions.

This finding is consistent with a large body of literature on environmental risk governance, which highlights the marginalization of local perceptions, lay knowledge, and lived experiences in institutional decision-making processes. The results therefore largely confirm existing theoretical approaches that describe environmental governance as expert-driven and weakly participatory, particularly in post-industrial contexts.

However, the empirical findings also nuance the literature by showing that this top-down model is not only a matter of institutional resistance, but is reinforced by the complexity of actor configurations and knowledge asymmetries in post-mining territories. For citizens, identifying responsibilities, actors, and causal chains related to post-mining risks remains particularly difficult. This helps explain why participatory tools, even when well intentioned, struggle to achieve genuine co-construction.

From a pragmatic sociology perspective, the results support the idea that more inclusive governance requires hybrid mechanisms combining institutional expertise with experiential and situated knowledge. Environmental and health crises act as moments of tension that reveal the limits of technocratic governance and the need for territorially grounded approaches. In this sense, the experimentation carried out in this research confirms theoretical assumptions that risk is not only a technical object but a socially constructed phenomenon shaped by experiences, values, memories, and worldviews.

Based on these findings, several operational recommendations can be formulated, grounded in what this research has empirically demonstrated rather than in normative expectations of participation. These include:

- Formal recognition of citizen-produced or experience-based data as complementary inputs to institutional risk assessments, without assuming immediate co-decision.
- Training public officials and technical experts to interpret, contextualize, and integrate situated knowledge, particularly in conflict-prone territories.
- Development of intermediary deliberative spaces that prioritize dialogue and mutual learning over full co-construction, with clearly defined roles and realistic degrees of influence.
- Gradual and reflexive deployment of participatory tools, such as Serious Games, accompanied by continuous evaluation to avoid symbolic participation and to assess their actual contribution to understanding, mediation, and policy learning.

Overall, the theoretical framework serves here less as a model to be validated or invalidated than as a lens through which the results can be interpreted. The experimentation conducted highlights the conditions and limits for such approaches to become operational and socially meaningful in post-mining environmental governance.

The authors wish to thank ADEME (French environmental agency) and DPSM (Post-mining division of the French geological survey) for support this research by funding three years of doctoral study.

References

- Akrich M, Barthe Y, Rémy C (2010) *Sur la piste environnementale : menaces sanitaires et mobilisations profanes*. Presses des Mines.
- Amalric M, Anselme B, Bécu N, Delay E, Marilleau N, Pignon C, Rousseaux F (2017) “Sensibiliser au risque de submersion marine par le jeu ou faut-il qu’un jeu soit spatialement réaliste pour être efficace ?”, *Sciences du jeu* [Online].
- Arborio AM, Fournier P (2005) *L’observation directe*, Collection, 128.
- Arnauld de Sartre X, Chailleux S (2021) Introduction. L’incomplète mise en politique du sous-sol français. *Nature Science Sociétés* 29: S2–S11.
- Arnauld de Sartre X, Chailleux S (2026) When a forest is masked by trees: How French subsurface industries involved in decarbonisation and transition policies are instrumentalising poor social acceptance, *Energy Research & Social Science*, Volume 132. <https://doi.org/10.1016/j.erss.2025.104517>.
- Barthe Y, De Blic D, Heurtin JP, Lagneau É, Lemieux C, Linhardt D, Moreau de Bellaing C, Rémy C, Trom D (2013) Sociologie pragmatique : mode d'emploi. *Politix*, 103(3), 175-204.
- Beck U (2001 [1986]) *La Société du risque: Sur la voie d'une autre modernité* [« Risikogesellschaft »], Aubier, 521 p.
- Bertaux D (2010) *Le récit de vie*. L'enquête et ses méthodes, Armand Colin, Collection.
- Bessy C, Chateauraynaud F (1995) *Experts et Faussaires*. Pour une sociologie de la perception, Paris, Métailié, 365 pages.
- Blanchet A, Gotman A (2015) *L’entretien*, Armand Colin.
- Blondiaux L (2008) *Le nouvel esprit de la démocratie. Actualité de la démocratie participative*. – Paris, Seuil, La République des idées.
- Blondiaux L, Sintomer Y (2002) L'impératif délibératif. *Politix*, 57(1), 17-35.
- Boltanski L, Thevenot, L (1991) *De la justification: les économies de la grandeur*, Paris, Gallimard, 485 p.
- Bonincontro T (2024) *Construire l’habitabilité des territoires post -miniers cévenols, entre visibilité et invisibilisation des perturbations post-minières*. Thèse de doctorat en géographie, sous la direction de Sylvia Becerra et Pierre-Michel Riccio, Institut Mines-Telecom (IMT) – Ecole Nationale Supérieure des Mines d’Ales, 379 p.
- Borraz O (2008) *Les politiques du risque*. Paris : Presses de Sciences Po. « Académique », p.296.
- Busca D, Lewis N (dir) (2019) *Penser le gouvernement des ressources naturelles*, Presses de l’Université Laval.
- Busca D, Chauveau L, Bontemps M, Meidani A, Dumat C (2023) *Habiter (avec) la pollution. Pratiques et perceptions des risques par les habitants riverains de la vallée de l’Orbiel*.

- (11), rapport de recherche, MSHS de Toulouse (UAR3414), CERTOP (UMR5044), Université Toulouse – Jean Jaurès (UT2J), Santé publique France, juillet, Toulouse.
- Callon M, Lhomme R, Fleury J (1999) *Pour une sociologie de la traduction en innovation*. In: Recherche & Formation, N°31. Innovation et formation des enseignants, sous la direction de Françoise Cros. pp. 113-126.
- Callon M, Lascoumes P, Barthe Y (2001) *Agir dans un monde incertain*. Essai sur la démocratie technique, Paris, Le Seuil.
- Cefaï D (1996) La construction des problèmes publics. Définitions de situations dans des arènes publiques. *Réseaux*, 75(1), 43-66.
- Cefaï D, Terzi C (2012) *L'Expérience des problèmes publics*, Paris, Éditions de l'EHESS (collection « Raisons Pratiques », 22).
- Chateauraynaud F, Torny D (1999) *Les Sombres précurseurs, une sociologie pragmatique de l'alerte et du risque Paris*, Éditions de l'École des Hautes Études en Sciences Sociales, Paris, 1999, 480 p.
- Chateauraynaud F (2011) *Argumenter dans un champ de forces. Essai de balistique sociologique*, Éditions Petra, Paris. 482 p.
- Chilvers J, Kearnes M (2015) *Remaking Participation Science, Environment and Emergent Publics*, Routledge, 314 p.
- Crivellari P (2024) *Les risques environnementaux et sanitaires. Politiques publiques, mobilisation de citoyens et innovation*. [Habilitation à Diriger des Recherches] Université de Toulouse 3 Paul Sabatier.
- De Sousa CA (2006) Unearthing the benefits of brownfield to green space projects: An examination of project use and quality of life impacts. *Local Environment*, 11(5), 577–600.
- Dewey J (1927) *The Public and its Problems* [Le public et ses problèmes (2001)], The Later Works, vol. 2, Carbondale, Southern Illinois University Press.
- Douglas M, Wildavsky A (1982) *Risk and culture. An essay on the selection of technological and environmental dangers*. Berkeley, University of California Press, 221 p.
- Fischer F (2000) *Citizens, Experts, and the Environment: The Politics of Local Knowledge*. Duke University Press.
- Fricke M (2007) *Epistemic Injustice: Power and the Ethics of Knowing*, Oxford Academic.
- Fung A (2006) Varieties of Participation in Complex Governance, *Public Administration Review*, Vol. 66., pp. 66-75.
- Giddens, A (1991) *Modernity and Self-Identity: Self and Society in the Late Modern Age*. Cambridge: Polity.
- Giddens A (2000) *Les conséquences de la modernité* [« The Consequences of Modernity »], L'Harmattan.
- Gilbert C (2003) La fabrique des risques. *Cahiers internationaux de sociologie*, 114(1), 55-72.
- Gilbert C (2014) *Crise*. In: Kada N, Mathieu M, Dictionnaire d'administration publique (p. 125-126). Presses universitaires de Grenoble.
- Gourgues G, Mazeaud A, Nez H, Sainty J, Talpin J (2021) Les Français veulent-ils plus de démocratie ? Analyse qualitative du rapport des citoyens à la politique. *Sociologie*. 12(1), 1-19.
- Halbwachs M (1992) *On Collective Memory*, Edited, translated, and with an Introduction by Lewis A. Coser, Heritage of Sociology Series, University of Chicago Press, 254 p.
- Hassenteufel P (2011) *Sociologie politique : l'action publique*. Armand Colin.
- Irwin A, Wynne B (1996) *Misunderstanding Science? The Public Reconstruction of Science and Technology* (232 p.). Cambridge: Cambridge University Press.
- Jacob E, Magnani F (2024) *Former à l'interdisciplinarité via l'intégration du design à la gestion de projet : apports et limites dans une école d'ingénieurs*. Revue internationale de pédagogie de l'enseignement supérieur, 40.

- Jasanoff S (2004) *States of knowledge: the co-production of science and the social order*. Routledge, London.
- Jasanoff S, Martello ML (Eds.) (2004) *Earthly politics: Local and global in environmental governance*. MIT Press.
- Jules W, Dumat C (2022) *Analyse sociologique des transitions agroécologiques dans les jardins collectifs urbains à Toulouse*, Intelligence collective pour des transitions écologiques au service de notre alimentation et de la santé globale, 2022/3 N° 244.
- Lehoux P, Daudelin G, Denis JL, Gauthier P, Hagemeister N (2019) Pourquoi et comment sont conçues les innovations responsables ? Résultats d'une méta-ethnographie. *Innovations*, 59(2), 15-42.
- Mah A (2012) *Industrial ruination, community, and place: Landscapes and legacies of urban decline*. University of Toronto Press.
- Mélarde F, Gramaglia C (2022) Participation citoyenne et production de savoirs situés sur les pollutions: Retour sur deux expérimentations de biomonitoring de l'Institut écocitoyen pour la connaissance des pollutions de Fos (France). *Rev Anthropol Connaiss* 16(4).
- Mottis T, Dumat C, Baills A, Andriamasinoro F, Bellenfant G, Berry S, Lebot B, Busca D (2022) Écologisation de la gestion des sites post-mines: co-construction des connaissances et usages Du décloisonnement de l'expertise à la dimension relationnelle des activités techniques. *Pour*, 244(3), 111-122.
- Nowotny H, Scott P, Gibbons M (2001) *Re-thinking science: knowledge and the public in an age of uncertainty*, Cambridge, Malden (Mass.), Blackwell Publishers.
- Lagadec P (1991) *La gestion des crises : outils de réflexion à l'usage des décideurs*, McGraw-Hill, Paris, 326 p.
- Lascoumes P (1994) *L'éco-pouvoir* (environnement et politiques), Paris, La Découverte.
- Lascoumes P (2018) *Action publique et environnement*. (2e éd.). Presses Universitaires de France.
- Lascoumes P, Le Galès P (dir.) (2005) *Gouverner par les instruments*, Sciences Po, Les Presses, Paris.
- Le Breton D (2002) *Conduites à risque*, Paris, PUF.
- Gramaglia C (2023) *Habiter la pollution*. Expériences et métrologies citoyennes de la contamination, Paris, Presses des Mines, coll. "Sciences sociales".
- Ottinger G, Cohen B (2011) Environmentally just transformations of expert knowledge. *Local Environment*, 16(8), 747-764.
- Peretti-Watel P (2001) *La société du risque*, Paris, La Découverte.
- Pestre D (2011) Des sciences, des techniques et de l'ordre démocratique et participatif. *Participations* N° 1(1):210-238.
- Slovic P (2000) *The perception of risk. Risk, society, and policy series*. Earthscan Publications, London, 473 p.
- Weber M (1978) *Economy and Society: An Outline of Interpretive Sociology*. Berkeley, CA: University of California Press.
- Wynne B (1993) Public uptake of science: a case for institutional reflexivity. *Public Understanding of Science*, 2(4), 321-337.
- Wynne B (2013) *Radioactivity in the Environment*, Chapter 16 - Social Identities and Public Uptake of Science: Chernobyl, Sellafield, and Environmental Radioactivity Sciences, Editor(s): Deborah Oughton, Sven Ove Hansson, Pages 283-309.
- Zask J (2008) Le public chez Dewey : une union sociale plurielle. *Tracés: Revue de Sciences Humaines*.