



The Long Road Towards the Soft Nuclear Repository State: Nuclear Waste Governance in Germany

Maria Rosaria Di Nucci and Achim Brunnengräber

5.1 Introduction

The decision-making processes in the field of high-level radioactive waste (HLW) in the Federal Republic of Germany (and the former German Democratic Republic (GDR) until 1989) have been dominated by the decide-announce-defend (DAD) strategy. This approach, which endured until the beginning of the last decade, led to conflicts with civil society, mistrust of authorities and block-ages, and can be epitomised by the expression “nuclear state”, a term coined by Robert Jungk (1986). Nuclear policy decisions were also enforced with police coercion. Consequently, massive resistance from the anti-nuclear-movement developed against the state and the planned final geological repository waste

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M. R. Di Nucci (✉) · A. Brunnengräber
Freie Universität Berlin, Forschungszentrum Für Nachhaltigkeit (FFN), Berlin,
Germany
e-mail: dinucci@zedat.fu-berlin.de

A. Brunnengräber
e-mail: Achim.Brunnengraeber@FU-Berlin.de

site at Gorleben. A stop and go policy came after each decision, characterised by court orders allowing construction followed by occupation of the site by the anti-nuclear movement (Roth and Rucht 2008; Rucht 1980).

Commencing in 2010, after more than 60 years of nuclear energy deployment, the political balance of power in the energy sector in Germany has fundamentally changed. The movements against nuclear power and the transport as well as storage of radioactive waste have grown stronger over the decades and are now key political actors in the current siting process for deep geological disposal (DGD). Part of the anti-nuclear movement has integrated into the institutions, e.g. political parties and the German Bundestag, and contributed significantly to the decision in 2011 to completely phase out nuclear power.

Subsequent to the decision in 2011 to phase out nuclear power plants (NPPs) in Germany by 2022, and with insight into the failures of the past, an ambitious *Repository Site Selection Act* (StandAG) was passed in 2013, and amended in 2017. This Act provides the framework for the establishment of new state institutions and a far-reaching participation procedure involving civil society and stakeholder groups.

The search for a DGD site that offers the greatest possible safety and security potential was started with a blank map, potentially considering the whole of Germany. In September 2020, following the release of a preliminary report evaluating regions with potentially suitable host rock formations for a DGD, the Federal Company for Radioactive Waste Disposal (Bundesgesellschaft für Endlagerung mbH (BGE)), acting as the operator, designated around 90 potential areas across Germany (BGE 2020). The overall geological situation in Gorleben was assessed as “unfavourable” and the site was eliminated in this first round, putting an end to a decades-old conflict. Yet the process is still confronted with significant resistance and hence challenges. It was planned to find a suitable, socially acceptable location by 2031 and to dispose of all HLW by 2080. In November 2022, the operator BGE announced that the search for the site would take much longer and indicated a timeframe between 2046 and 2068. It is expected that Germany will now have to elaborate a concept for a long-term interim storage facility as is already the case in several European countries.

This chapter analyses the multi-level governance of HLW in Germany by focusing on the following domains: (1) legislation, politics & administration, (2) science & technology, (3) civil society and (4) the interactions between them. The chapter is structured as follows: In Section 5.2, we provide a short historical account of German nuclear waste management and discuss the wickedness (Brunnengraber 2019b) of the waste problem. In Sect. 5.3, we address governance aspects and analyse the legal, political and institutional domains. We focus

on legal aspects of the StandAG, especially those providing the framework for the other domains. Section 5.4 is dedicated to the scientific and technological domain, and we analyse in particular the role and function of experts. In Sect. 5.5, we turn to the societal domain and its interactions with the other domains and focus on the current participatory process for a DGD siting. In the conclusion we emphasise that procedural fairness and inclusiveness of the process remain important and necessary prerequisites for building public confidence and for the social acceptability of the political siting decisions. We maintain that the legal framework and the StandAG leave many unresolved issues, but this permits extensive room for manoeuvre and represents an opportunity for new and expanded forms of participation to be pursued.

5.2 From the Hard Nuclear State to More Participatory Approaches

5.2.1 Historical Context¹

The Federal Republic of Germany had an early start in the use of nuclear power. Between 1961 and the end of the 1980s, 36 NPPs entered into commercial operation. In 2005/2006 Germany's 17 NPPs supplied almost one-third of the country's electricity, but this share has fallen steadily. In 1998, the newly elected Social Democratic/Green government radically changed the previous nuclear policy, and in 2000 announced the nuclear consensus (Atomkonsens) that enabled the phase-out of NPPs within two decades. In 2009, the subsequent conservative Christian Democratic/liberal government announced a 12-year extension of the scheduled phase-out, which provoked harsh protests, especially from the Green Party and the anti-nuclear-movement. In the aftermath of the Fukushima disaster in 2011, the same government reversed its previous plans and decreed the definitive phase-out by 2022. (World Nuclear Association 2022). Following the Russian invasion of the Ukraine and the subsequent turmoil on the energy markets, the shutdown of the last three NPPs still in operation has been postponed until April 2023.

¹For reasons of space we can only supply a brief historical account of the nuclear waste policies in Germany, thus for the early years of nuclear development and waste treatment, we refer to a number of important publications (see among others Blowers (2017, 2019), Hocke and Renn (2009); Kamlage et al. (2019); Radkau and Hahn (2013). This Section builds heavily upon Di Nucci et al. (2021b).

The advance and decline of nuclear power in Germany has been characterised by conflicts and intractable disputes. Public opinion widely opposed building NPPs, and public debate, the extra-parliamentary opposition and the anti-nuclear movement enjoyed broad societal and partially political support (Rucht 2008). The anti-nuclear movement emerged from the peace movement, but the dangers and risks of nuclear energy triggered the wider mobilisation of civil society.² The search for a DGD site for HLW has equally been accompanied by strong public opposition.

The roots of the problem date back to the 1970s, when plans for an integrated reprocessing and waste disposal site in Gorleben, a village in a rural area in the northern German state of Lower-Saxony with salt rock geological conditions, were announced. While plans for the reprocessing plant were discarded, Gorleben remained the designated site for a waste repository (Blowers, 2017; Tiggemann 2019). Di Nucci et al. (2021b) argue that the German government strategy until 2013 rested heavily on a politically driven top-down approach. The fact that all nuclear waste sites for HLW and LLW (Gorleben, Asse, Konrad and Morsleben) were designated top-down by government decisions triggered conflicts and polarisation and led to a growing mistrust of state institutions (Di Nucci et al. 2021b).

The loss of trust in state and federal state authorities by the anti-nuclear movement and the population directly affected by nuclear facilities can be attributed, among other reasons, to a process described as “messy muddling through” (Hocke and Renn 2011). Government institutions and responsible political actors had no coherent action plan and reacted to protests with harsh and repressive measures (Roth and Rucht 2008). The failure of the “nuclear state” in governing and regulating nuclear waste can be partly ascribed to earlier political-administrative control concepts, economic interests, and repressive attitudes towards local and civil protests (Kamlage et al. 2019). Di Nucci et al. (2021a) point out that the long-standing dualistic role of state institutions as both advocates and watchdogs in the nuclear field rendered a neutral moderating position problematic, if not impossible, for example with regard to civil society demands for participation and transparency in decision making.

However, an adaptation of political institutions, the expansion of renewable energies and the introduction of new participatory elements in policymaking has taken place. Following the change from the conservative Christian Democratic-

²It is interesting to note that the very large public demonstrations, especially in 1979, were induced by both national and international events; the international expert hearing about Gorleben in Hanover, Germany, and the Three Mile Island accident in Harrisburg in the USA. See Rucht (1980).

Liberal coalition in 1998 and the establishment of a red-green cabinet, revision of the nuclear policy culminated in a moratorium in 2000. The agreement of 14 June 2000 between the federal government and the energy companies for the phasing out of nuclear energy, also agreed a moratorium on the planned repository at Gorleben. This put exploratory activities for a DGD at Gorleben on hold for a period of three to ten years. The moratorium's goal was to settle questions, especially about the feasibility of the salt dome (Tiggemann 2019, p. 79).

Under the red-green government, the potential for the moratorium to induce trust remained rather limited, and the initial government-industry consensus led to a rather limited engagement of opposition groups in discussing a possible disposal strategy (Di Nucci et al., 2019). In the political process, the positions of the various interest groups hardened and the lines of conflict became more rigid, so that no progress could be made. It was only in 2011 that the conflictual relationship between the state and civil society, and between the opposing parties, was somehow smoothed by the Fukushima nuclear reactor disaster and the subsequent nuclear phase-out. One could claim that the divide between nuclear power advocates and opponents became less dramatic following the phase-out decision. Nevertheless, despite the significance of this decision and its potential to build trust between political actors and create confidence in a fresh start for nuclear waste policies, conflicts did not vanish entirely. One of the reasons for this could be that the phase-out decision was triggered by an exogenous event, and was not reached through a critical consideration of past development paths, or because of an intrinsic and endogenous awareness of the problem (Di Nucci et al. 2021b). Yet, with the adoption of the StandAG in 2013, the German Bundestag made a first move to revise the technical path dependency of a research and nuclear waste policy exclusively oriented towards DGD in salt rock formations. In the ongoing process, clay and crystalline rock formations are also taken into consideration.

5.2.2 The Nuclear Waste Problem Today

To date, there has not been a complete survey of the volume of radioactive waste produced in Germany or of the amount that can be expected in the future. The inventory of radioactive waste is difficult, because different sources use different designations for the volume of waste, and different units (tonnes, cubic meters, etc.) for its measurement. The classification of waste is thus rather complex and is also dependent on the method of disposal (e.g. surface or DGD). Because the plans envisage the disposal of all radioactive waste types in DGD, following the dose rate, it is the (related) heat generation during radioactive decay that is key for the classification and hence the inventory in Germany. Germany has used its

own classification system since the mid-1980s, and distinguishes between heat-generating waste and waste with negligible heat generation. Differing slightly from the International Atomic Energy Agency (IAEA) classification, nuclear waste is thus categorised into high-level radioactive waste (HLW), intermediate-level active waste (ILW) and low-level active waste (LLW). Heat-generating waste includes HLW and part of ILW. Waste with negligible heat generation corresponds to the categories of LLW and to the major part of ILW, i.e. the IAEA classification of very low-level waste (VLLW) and low-level waste (LLW), and intermediate-level waste (ILW) (BASE 2016).

According to the BGE, Germany has accumulated approximately 27,000 cubic meters of HLW (BGE n. d.). Currently, nuclear waste with different radioactive levels is scattered across different federal states. The majority of it is hosted in facilities at the nuclear reactor sites, at interim storage facilities or at the facilities for packaging and repackaging. Non-reprocessed spent fuel is stored in twelve interim storage facilities; vitrified reprocessed waste and spent fuel is stored at the three centralised storage facilities at Gorleben, Ahaus and Lubmin (see Fig. 5.1). Waste produced through the reprocessing of fuel in the UK and France has partially been returned to Germany or is expected to be returned in the near future. In addition, about 300,000 cubic meters of LLW and ILW are expected from NPPs, research centres, industry and medical facilities (BASE 2020). Furthermore, 100,000 cubic meters stem from the uranium enrichment facility at Gronau, and 220,000 cubic meters from Asse rock salt mine (Asse II, see below). The size of the future DGD facility cannot be decided until the host rock and the according container concept have been determined.

The former iron ore mine, Konrad, in Lower Saxony, is licensed as a final repository for LLW and ILW. Starting in 2007, it was converted into a repository and is expected to be put into operation by 2027. Between 1976 and 1978, Asse II, in Lower Saxony, was used to dispose, at a depth of 650 m, 125,787 drums and casks with LLW and ILW, and a further 1300 drums with ILW from NPPs and the Karlsruhe nuclear research facility (BMUV 2021). Every day, 12,000 L of water trickle into the mine and have to be pumped out. Therefore, the casks stored there are to be retrieved by 2033. The final closure of the Asse II mine is expected by 2050 at the earliest, but a roadmap is not available yet (Niedersächsische Staatskanzlei 2021).

Following the reunification of Germany in 1990, responsibility for the former repository for LLW/ILW of the German Democratic Republic (GDR) in Morsleben (ERAM) was transferred to the Federal Republic of Germany. The emplacement of radioactive waste took place until 1998, and has been completed. Approximately 37,000 cubic meters of LLW and ILLW are stored here at a



HLW in Germany

- Central Interim Storage
 - ▲ NPP Interim Storage
 - ▲ Interim Storage
 - Sub Areas
 - Federal States
- Name of Site**
(No. of CASTOR Casks/ Authorised Until)
- Data: BGE, BASE, BGZ, atommüllreport*
Cartography: L. Schwarz
Date: January 2022

Fig. 5.1 Location of nuclear facilities where HLW is temporarily stored



LLW/ILW in Germany

- Planned Final Repository
- ✗ Wrecked Final Repository
- ▲ Interim Storage
- ▲ Federal Collection Facility
- Sub Areas
- Federal States

Data: BGE, BASE, BGZ, atommüllreport
 Cartography: L. Schwarz
 Date: January 2022

Fig. 5.2 Location of nuclear facilities where LLW/ILW is temporarily stored

depth of around 480 m. Stabilisation measures have been carried out since 2003. Morsleben is the first German repository that is to be decommissioned under the German Atomic Energy Act, with the waste being retained.

5.3 Nuclear Waste Governance: Legislation, Politics, Administration

5.3.1 The Legal Framework

The major instrument of the legal framework for HLW is represented by the *Repository Site Selection Act* (StandAG 2017). In spite of widespread critique, the law represented a novelty in the German legislative system, which had not previously regulated the siting process (Hocke and Kallenbach-Herbert 2015). This Act sets out exclusion criteria, minimum requirements and consideration criteria as well as requirements for the organisation, the procedure of the selection process, the examination of alternatives and public participation. Moreover, it establishes a transparency norm. It was the outcome of a long procedure made possible through a compromise between political parties and other involved stakeholders about a stepwise approach for siting a DGD (Smeddinck 2019).

Starting from a blank map, the site for the final disposal of HLW should be found through a science-based and transparent procedure, and is to be carried out in a participatory, science-based, transparent, self-questioning and learning process (StandAG 2017, §1(1)). In principle, all three host rocks (salt, clay and crystalline) can be considered. The best possible site should be selected in a comparative procedure and should be able to guarantee the safe containment of the waste for a period of one million years. However, the repository should be sealed with the possibility of retrieval for the duration of the operating phase for 500 years after closure.

5.3.2 The Political Dimension, Institutional Framework and Main Actors

German nuclear waste governance is shaped by several socio-technical interdependencies at various levels (Brohmann et al. 2021). We find ministries of the German Federal Government (Bund) and the federal state governments (Bundesländer), local authorities (mayors, city councils), and civil society (environmental organisations, anti-nuclear movement, citizens' initiatives). The political feedback between these levels of action and decision-making (from federal to local and vice-versa) are not always transparent. These interdependencies will

continue to play a role in the future, as recent developments already show as the relationship continues to be characterised by conflicts and different approaches of how to handle the *wicked problem* of nuclear waste (Hocke and Brunnengräber 2019). Such a problem is difficult or impossible to solve due to incomplete, contradictory and changing requirements that are often difficult to identify.

The enactment of the StandAG in 2013 was the result of a compromise between the political parties at the national level which was agreed in the Bundestag. However, the consensus became fragile. At the federal state level, there has been no explicit backing for a restart of site selection, as only Baden-Wuerttemberg, Lower Saxony and Schleswig–Holstein supported the siting for a DGD in the following years. By contrast, other federal states declared that they would not qualify for siting. This shows that the search for the best location will not only be science-based, but also politically influenced.

A multiplicity of actors is involved in the decisions regarding multi-level governance of nuclear waste. Häfner (2016) identified 300 institutional actors from a wide range of spheres, subdivided into state, market, science and civil society actors. The state includes state decision-making bodies, ministries, supervisory and authorising authorities. The market consists mainly of the nuclear industry and the electric utilities that operate NPPs and their respective lobbies and think-tanks, as well as several energy companies. However, responsibility for final disposal was handed over to the state. In addition, civil society includes various environmental, peace and anti-nuclear organisations, as well as many regional and site-specific citizen initiatives (Häfner 2016).

Federal states, especially Lower Saxony, where Gorleben is located, took a central role. At the central federal governmental level, in the past, HLW fell within the remit of various federal ministries and the subdivision of responsibilities changed over time. As of June 2022, major responsibilities lie within the Ministry of Environment, Nature Protection, Nuclear Safety and Consumer Protection (BMUV). The Ministry for Economy Affairs and Climate Action (BMWK) and the Ministry of Education and Research (BMBF) also share responsibilities. The BMUV is the supervisory authority and thus the highest federal authority in the siting process. This means that all decisions by the regulator in its area of responsibility must be taken in accordance with the requirements of the Ministry, be continuously reviewed, and may be amended by the BMUV at any time.

5.3.3 The Institutional Actors

Germany established its new governance structure fairly recently in response to EU Directive 2011/70/EURATOM (European Council 2011). The StandAG man-

dated the reorganisation of the existing institutional structures and procedures, and ensured the required functional separation of the supervisory and licensing authority from all other government agencies or organisations involved in waste management. The StandAG stipulates a clear separation between the regulatory authority and the developer /implementer. However, the new waste governance is based on reformed rather than new institutions. As a result of this restructure, two powerful actors emerged: the Federal Office for the Safety of Nuclear Waste Management (BASE, Bundesamt für die Sicherheit der nuklearen Entsorgung³) as supervisory and licensing authority, and the Federal Company for Radioactive Waste Disposal (BGE, Bundesgesellschaft für Endlagerung mbH) as the operator responsible for the implementation.

The Regulator BASE

BASE is a higher federal authority under the supervision of the Federal Ministry BMUV, and independent of economic interests. It was established in 2014 on the basis of a provision of the StandAG (2013, § 7), and finally took up its duties in July 2016.⁴ The authority is tasked with:

- regulation, licensing and supervision in the field of long-term nuclear waste storage, interim storage and the handling and transport of radioactive waste,
- process management and enforcement monitoring in the site selection procedure for the long-term nuclear waste storage facility,
- the organisation of public participation in the search for a site.

BASE's responsibilities are the overall site selection procedure and the overall organisation of public participation. Within the competence of BASE we also find review of the quality of the information provided by the BGE and the release of its proposals (as BGE itself is not allowed to do this). Consequently, BASE has the legal obligation to prepare and distribute "comprehensive and systematic" information for the public, which is required by law.

The fact that ultimate responsibility for the site selection procedure and for public participation lies within the same authority is controversial. BASE itself

³Formerly the Federal Office for Safety of Nuclear Disposal (BfE, Bundesamt für kern-technische Entsorgungssicherheit).

⁴Act on the Establishment of a Federal Office for Nuclear Waste Management of 23 July 2013 (Gesetz über die Errichtung eines Bundesamtes für kerntechnische Entsorgung vom 23. Juli 2013—BGBl. I S. 2553, 2563).

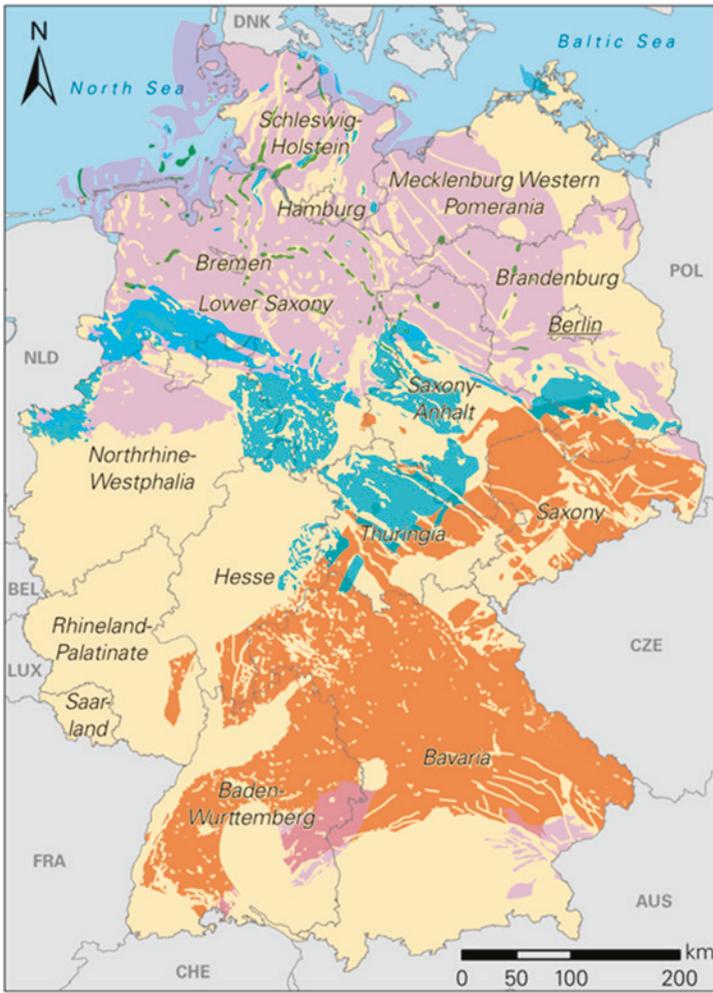
has addressed this problem, and declared that it finds itself caught between the legally required control of the procedure and the necessary cooperation with the other actors. The fact that in other countries, such as Belgium or Canada, this responsibility has been defined differently, and other bodies are responsible for public participation, shows that this is not, nor has to be, a core task of the regulatory authority (Di Nucci et al. 2021a).

The Operator BGE

BGE was established in December 2016 by merging three other institutions: the Federal Company for Radioactive Waste Disposal (DBE) was founded in 1979 as a company in charge of the planning, exploration, construction and operation of facilities for securing and disposing of radioactive waste. DBE, together with Asse-GmbH and parts of the BfS, were transferred to the BGE in 2017. It is important to note that since 2008, two-thirds of the DBE belonged to GNS (Gesellschaft für Nuklear-Service), which in turn belongs to the German NPP-operators. The DBE had been responsible for the operation and maintenance of the exploration mine in Gorleben, the construction of the storage facility for low and intermediate level radioactive waste in the mine Konrad, and decommissioning of the former DDR deep storage facility in Morsleben.

The BGE is under the supervision of BASE and is 100% owned by the BMUV.⁵ Gaßner et al. (2018) explain in this context that the technical supervision of the BGE under organisational law is the responsibility of the federal government and not BASE. Thus, the regulatory authority can neither influence nor control the fulfilment of the BGE's tasks. The BGE acts in accordance with StandAG (2017, § 3), and is responsible for operational activities (establishment and operation of DGD facilities), and implementation of the repository site selection procedure and informing the public about the initiated steps and measures of the process. In the first phase of the procedure (see Sect. 5.2) the BGE designated sub-areas in which host rock formations can potentially be found (Fig. 5.3). In the second phase, potential regions are to be explored by the BGE. During the final phase, it is responsible for site-related exploration programmes and assessment criteria.

⁵Section 9a (§ 3) of the Atomic Energy Act (AtG) stipulates that the Federal Government “shall entrust the performance [of the securing and disposal of radioactive waste] to a third party, which shall be organised in a private legal form and of which the Federal Government is the sole shareholder”.



Sub-Areas pursuant to Section 13 RSS-Act

Host Rock Formation

- Rock Salt (Steep)
- Rock Salt (Stratiform)
- Claystone
- Crystalline

Federal States

*Data: BGE
 Cartography: L. Schwarz
 Date: January 2022*

Fig. 5.3 Potential sub-areas according to host rock formation

The Oversight Committee NBG

The National Citizens' Oversight Committee (Nationales Begleitgremium, NBG) was established in 2016 under the responsibility of the BMUV. It was set up upon recommendation by the "Commission for the Disposal of High-Level-Waste" (EndKo 2016). Its members may neither belong to a legislative body nor to a federal or provincial government, nor can have any economic interests in the site selection (Di Nucci et al., 2021b). In addition, lay persons and the younger generation are represented. Some observers maintain that participation of lay citizens on this board can help restore trust, as laypeople are expected to be driven less by self-interest and more by concern for the common good (Schreurs and Suckow 2019).

The NBG advises institutions in the site selection procedure until the siting decision. Its tasks encompass mediating the process and accompanying the public participation process. The focus of the NBG is not only monitoring the process; it also sees its task as building and continuously maintaining trust between the actors involved. However, the NBG is subordinate to the BMUV and thus not entirely independent. Until now, the NBG has had little influence, and its recommendations representing public input so far have only been marginally considered. Parts of the anti-nuclear-movement have considered the work of the committee rather critically from the very beginning (Ehmke 2020).

5.4 The Science & Technology Domain. Dealing with Expert/lay Knowledge and Society

5.4.1 Science, Technology and Civil Society

In the German case, "safety first" remains the main principle. Attributing priority to safety aspects over other criteria in all decisions related to the search and construction of a final repository is imperative. The technical safety aspects point to the socio-technical complexity of the challenging disposal measures. Factors to be considered range from political issues related to conditions for retrievability (in the first 500 years), to different types of host rock or the so far very limited standardisation of containers.

The scientific community and expert panels have tended to regard such complexity primarily as a technical challenge that can be dealt with through established forms of scientific and engineering research and development (R&D). The rationale is that any risks arising can be reduced to an acceptable degree by taking adequate measures. In the selection process, social science and techno-scientific

criteria are alleged to have an important role. Yet, the so-called exclusion criteria such as earthquakes, fault zones, volcanic activity or influences from current or past mining activity, and minimum requirements such as thickness of the inclusion-effective rock mass area or the preservation of the barrier effect, are purely determined by technical and scientific criteria. The social-science based criteria are only applied at a later stage during the evaluation of the sub-areas.

Complex and *wicked problems* associated with the long term management of radioactive waste (Brunnengraber 2019b) require an integrative analysis and contextualised planning. Debates within society and science are nowadays expressions of uncertainties, both at the scientific and normative levels. This makes it difficult to define a clear long-term strategy. It is not possible to understand all the dynamics of such complex systems, in which *known unknowns* and *unknown unknowns* are frequently found (Eckhardt and Rippe 2016). To offer solutions or to possess extensive knowledge is no longer considered an exclusive capability of scientists. Due to the many unanswered questions about DGD (which repository concept, which host rock, which container? etc.), interdisciplinary expert knowledge and transdisciplinary research is called for as a productive source for making the best possible decision in balancing risk technologies with societal interests and concerns.

BASE conducts research to fulfil its duties in the field of the tasks assigned to it by the StandAG. Research is carried out at two levels: firstly, BASE is involved in the implementation of the BMUV's research (BASE 2019), which forms the scientific advisory basis for political decisions; secondly, BASE has a specific research budget for nuclear safety. Furthermore, additional research projects can be supported through third-party funding, e.g. from the European Union. The research priorities and central goals are defined in the research strategy and agenda under the BASE research budget (BASE 2019). For this, BASE appoints external experts and/or participates in third-party funded projects and research networks. This procedure has been criticised, but BASE's own R&D is justified by the need to maintain its own supervisory expertise and by the need for competent and independent examination of the operator's proposals and arguments. The OECD/NEA also points out that scientific and technical expertise is strengthened when relevant R&D is carried out directly by the regulator (OECD-NEA 2010).

5.4.2 The Role of Experts and Committees

In the field of radioactive waste governance there is a tradition of interdisciplinary expert committees that have advised various governments. Isidoro Losada et al.

(2019) examined the work and background of five advisory bodies and tried to shed some new light by juxtaposing the way these commissions provided expert advice and enlarged the level of understanding of the socio-technical challenges connected to nuclear waste. They stated that the design and performance of advisory bodies has started to change, and to show a slow development towards more openness and plurality to increase robustness in decision-making (Isidoro Losada et al. 2019).

Amongst the most prominent committees in Germany we find the ad-hoc working group on the “Selection Procedure for Repository Sites”, known as AkEnd, which was established in 1999 as an interdisciplinary expert advisory body and was in charge of analysing scientifically proven criteria for searching for a repository site. In its final report in December 2002, AkEnd recommended a number of criteria for site selection and new forms of participatory governance. AkEnd was the first expert board to point out the importance of socio-political criteria and of participation for the siting process, and of public involvement in the decision-making process, traceability and transparency of the information, as well as the acceptance of the affected population (AkEnd 2002).

In 2014, a new site selection commission for a repository, EndKo, was set up. It consisted in total of 34 representatives from the political and scientific communities as well as civil society, and its tasks were defined by the StandAG. This commission represented a milestone, marking a new beginning in the relation between state and society. Its main task was to work out the basic principles for decision-making concerning site selection for a DGD. These included the definition of procedural steps within the selection process, the development of criteria used for the site selection as well as the design of the process of public participation (EndKo 2016; BASE 2021). In its constituent meeting in 2014, the Commission stressed its intention to build upon the work of AkEnd, especially with respect to the aim of a systematic and transparent development of criteria for the search of a repository as well as public participation.

There appear to be strong similarities between the recommendations of EndKo and those put forward ten years earlier by AkEnd, especially with regard to the selection criteria (Isidoro Losada et al. 2019). For both commissions, concepts of safety and risk played an important role, and both considered natural science and technical criteria to be key to the identification of a potential repository site. This is not surprising, as there was also a strong continuity between the two commissions, ensured among other things by a number of experts that served on both commissions and who, however, brought along a number of old areas of conflicts. Nonetheless, both AkEnd and EndKo recommended a site selection procedure with a participatory process that goes beyond basic participation, which was later agreed upon in the StandAG.

The selection and participation of the experts in the new commission and the limited opportunities to influence the outcome have been widely rebuked by the anti-nuclear movement, and by a large number of environmental organisations and initiatives (Brunnengraber 2019a, 110 ff). Thus, the enactment of the StandAG and the work of EndKo showed once again that conflicts have historical roots, and the legacy of the past affects the work and discussion towards the search for solutions.

5.5 The Civil Societal Domain and Its Interactions with the Institutional and Scientific Domains

5.5.1 German Civil Society and the Nuclear Issue

Both the construction of NPPs and the DGD option have been controversial in Germany. The anti-nuclear movement was formed in the early 1970s, but fundamental demonstrations against nuclear power started as early as 1968, in Würsgassen. Further milestones of the movement were the occupation of the Whyll construction site in 1975, mass demonstrations in Grohnde, Brokdorf and Kalkar in 1976 and 1977, and the resistance against the planned reprocessing plant in Wackersdorf between 1981 and 1989 (Radkau 2011; Rucht 2008). The names of these sites are still iconic for the movement regarding the strong polarisation of West German society in dealing with nuclear power. The mass protests against the Castor transports⁶ to Gorleben between 1977 and 2000 denounced the risks of nuclear energy and of the inadequate disposal programme of the various federal state governments. Through the establishment of the Green Party in 1980, anti-nuclear protests became institutionalised in the political party system of West Germany (Kolb 2007).

Indeed, Gorleben remained a synonym for German nuclear conflicts, and has been a permanent subject of the discourse on nuclear issues (Blowers 2019; Blowers and Lowry 1997). More recently, nuclear opponents considered the initial non-exclusion of the Gorleben site from the current siting process as a signal for the path continuity of the nuclear policy of conservative parties and governments. Even after the enactment of the StandAG in 2013, due to the distrust

⁶“Castors” are special containers for storing and transporting highly radioactive materials, for example spent fuel elements from NPPs or vitrified waste from reprocessing.

accumulated under the previous disposal policy there was a strong concern that the “politically driven” selection of Gorleben could be legitimised through the new participation procedure (Di Nucci 2019). The citizens’ initiatives of the Gorleben region persistently pointed out that—because of the intensive exploration in the past—the Gorleben salt dome should have been excluded from the new search (Kamlage et al. 2019; Tiggemann 2019).

Large infrastructure projects call for robust decision-making procedures; this is especially true in the case of the final disposal of radioactive waste, in particular because of the extremely long-time horizon involved. Over the years there have been growing social expectations and a quest for participatory elements. This is especially linked to the legacy of the past top-down nuclear waste siting policy, which provoked enormous damage to public confidence vis-a-vis the state institutions.

The StandAG stipulates that [t]he public participation procedure shall be further developed accordingly. For this purpose, the parties involved may make use of further forms of participation beyond the minimum requirements stipulated by law. The suitability of the forms of participation shall be reviewed at “appropriate intervals.” This provides an incentive for a critical reflection on the participatory process. If the public is not involved, it will be unlikely to “find a solution that is supported by a broad social consensus and can thus also be tolerated by those affected” (StandAG, 2017, Sect. 5.5 (1)).

5.5.2 Participation and Consultation in the Site Selection Process

An important feature of the StandAG is the opening up of the path for the institutionalisation of public participation in nuclear waste governance (Hocke and Smeddinck 2017), even though the process leading to the entering into force of the law was itself not sufficiently participatory. The StandAG provides for transparent and dialogue-oriented public participation in the search for the best possible site.

In the public participation concept “Information, Dialogue, Public Participation in the Initial Phase of the Repository Search”, the regulatory authority points out that “transparent, open and confidence-building participation” is only possible if in particular the three stakeholders BASE, NBG and BGE (...) and in the further course of the procedure the regional conferences cooperate on a permanent basis (BfE 2019, p. 4), (BASE 2021). Actors from civil society and NGOs, such as the German Federation for the Environment and Nature Conservation

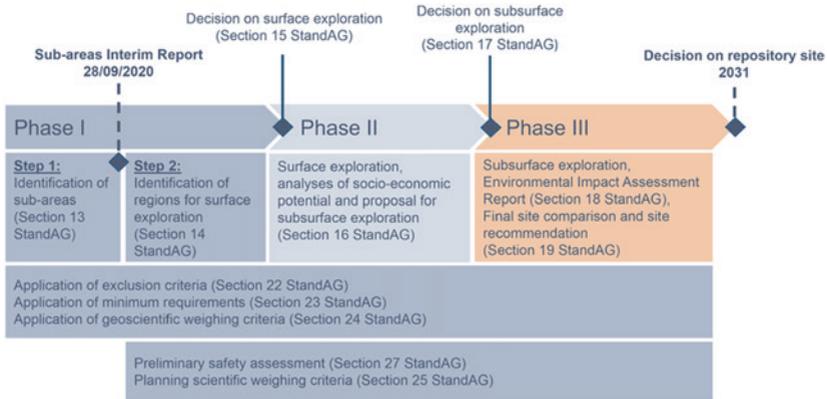


Fig. 5.4 Overview of the three phases of the site selection procedure. (Source: BGE 2020, p. 33)

(BUND), mistrusted the new approach and feared a low degree of openness with regard to their concerns (Schwarz et al. 2021a, b).

Against the background of previous experiences, it was declared that participation should not be limited to information and consultation modes (StandAG 2017). Instead, concerned citizens and stakeholders should be empowered to participate in a way that goes beyond previous participation patterns. (Themann et al. 2021a) remarked that such an approach requires an institutionalisation of and new forms of participation, but above all co-determination rights, as well as the provision of support measures for concerned citizens.

In the original intentions, the site for a DGD for HLW was to be found by 2031. As shown in Fig. 5.4, the site selection procedure in these plans could be subdivided into three phases. Against the newest postponement of the siting for the repository, the figure below is no longer realistic, but still provides a good overview of the phases and steps of the siting process. The operator BGE has refrained from further concretisation of the steps and timeline beyond 2031. Any further time estimate would be highly speculative and would only reflect a range of several possible scenarios.

- Phase I: Sub-regions and proposal for siting regions
- Phase II: Surface exploration
- Phase III: Underground exploration
- Final Phase: Site proposal and site decision.

In the first step of Phase I, the operator BGE carried out assessments on the basis of the exclusion criteria, minimum requirements and geo-scientific weighting criteria, and subsequently identified the so-called sub-areas, i.e. those areas with favourable geological conditions for the safe final disposal of HLW. At the end of this step 1 of Phase I, BGE published the interim report on the sub-areas. Subsequently, the regulator BASE organised the first standardised procedure for public participation, the so-called Sub-areas Expert Conference. This consisted of three conferences and was in part co-organised by major stakeholders, potentially affected municipalities and regional authorities, scientists, representatives of social organisations and citizens. This first step of Phase I was concluded in 2021.

Due to COVID-19 restrictions, BASE organised the kick-off event of the Sub-Areas Conference (Fachkonferenz Teilgebiete, FK TG) as an online event on 17 and 18 October, 2020. The FK TG was the regulator's first formal participatory event of Phase 1 (see Fig. 5.4) in the site selection procedure, and was intended to open up space for the participation of a broad public. It started with the first of three consultation meetings foreseen by the StandAG in February 2021. Expectations were correspondingly high. The aim of the kick-off event was to present the "Sub-areas Interim Report" published shortly before by the operator (BGE 2020) and to give all interested citizens, municipal representatives and civil society organisations the opportunity to ask questions about the report and the procedure. There was discussion about how the exclusion and consideration criteria as well as the minimum requirements were being applied, and about how the site search was going to move into the future. However, during the presentation of the results of the interim report on sub-areas, there were hardly any opportunities for critical questions or specific discussions of the questions formulated by the participants. Instead the moderator passed on selected and often bundled questions from the panel to the representatives of the BGE (Themann et al. 2021b).

The second consultation of the FK TG took place in June 2021, and the third in August 2021. These events concluded the first step in Phase 1. The use of learning elements, transparency, self-questioning and science-based criteria envisaged by the StandAG marked significant differences vis-a-vis the hard nuclear state approaches that previously shaped nuclear policy in Germany. Themann et al. (2021a, b, c) analysed the various events belonging to step 1 by conducting participatory, qualitative and quantitative observations based on the concept of *power over*, *power to* and *power with* (Partzsch 2017). The authors asked how power manifests itself while using the concept of the soft nuclear repository state as a normative orientation. They highlighted in particular heterogeneous public stakeholders, power asymmetries between state actors and civil society in the process, and the withdrawal of civil society actors who were not satisfied with the process.

Because the FK TG was not considered sufficient for the first phase of the site search, at the end of 2021 the Forum Endlagersuche was launched (Schwarz et al. 2021b). This, however, was not envisaged in the StandAG. The Forum is supposed to critically reflect on the work's progress and to discuss the way the state institutions develop siting regions for the coming phase of the procedure. It represents a forum for meeting, information, exchange, opinion-forming and co-shaping, with the goal to increase willingness to participate while providing an introduction to the topic of siting. As a preparatory step, members for the advisory and planning group of the Forum Endlagersuche were elected by the participants at a public event on 13 November, 2021. This group was kept in place until the first meeting/consultation of the Forum. BASE offered organisational support for the work of the forum and the advisory and planning group, and provide the resources necessary for the work.

In step 2 of Phase I, following publication of the interim report on the sub-regions, representative preliminary safety studies will be prepared for the sub-regions in question. According to § 27 of the StandAG, in the preliminary safety investigations the repository system is considered as a whole, and its safety is assessed in accordance with the state-of-the-art in science and technology. Preliminary safety investigations are key for the decision whether an area will be considered further in the selection procedure.

At the end of this complex assessment, the operator will propose to the regulator BASE siting regions to be explored above ground. The Bundestag and the Federal Council will then decide which siting regions are to be explored above ground. As soon as the siting regions have been designated by the BGE, BASE will initiate the establishment of so-called regional conferences. The regional conferences have extensive information and control rights in the further site selection procedure.

In Phase II, the BGE is expected to explore the siting regions whilst BASE reviews and approves these exploration programmes. On the basis of the exploration results, the BGE carries out further preliminary safety investigations according to the requirements and criteria defined in the StandAG. The BGE will then prepare socio-economic potential analyses in the siting regions, which will be discussed by the regional conferences. Subsequently, BASE will assess the proposals and determine exploration programmes and assessment criteria. At this point, the Bundestag and the Bundesrat will decide which sites are to be explored underground, and how. Thereupon, a judicial review is also possible before the Federal Administrative Court.

In Phase III, the underground exploration starts. The BGE explores the sites selected and prepares comprehensive preliminary safety assessments on the

basis of the exploration results and the requirements and criteria defined in the StandAG. On the basis of the results, which also include a comparative assessment of the sites, BASE performs an environmental impact assessment.

In the final phase, BASE assesses the BGE proposal, considering all concerns and the results of the participation procedure, to determine the site with the best possible safety. BASE will then submit the site proposal to the Federal Ministry for the Environment and Nuclear Safety. The final decision on the site is taken by the Bundestag and the Bundesrat.⁷

5.6 Conclusions

The socio-technical complexity of the nuclear waste governance and multilevel structures indicate that the political regulation of siting a DGD cannot be based on a singular understanding of the problem. Within the various stakeholder groups, up to now the definition of the problem, the social perception and attitudes to problem-solving are highly divergent and have been shaped by the legacy of the past, formal as well as informal rules, and political constraints. In the past, as well as during the ongoing siting procedure for a DGD, political regulation and the interests of the state actors, in particular BASE and BGE, were brought to the fore. However, their preferences and logics of action did not always match the preferences and expectations of civil society and NGOs, who have been active in the anti-nuclear movement in Germany for decades.

A lot has been done; governance mechanisms to improve participation have been set-up and reinforced, whilst state actors endeavour to engage the interested public more intensively. The siting procedure is required to be self-questioning, science-based, reversible, transparent, mutually learning and fostering participation on an equal footing between state and civil society. However, as long as a number of stakeholders (in particular the environmental NGOs and civil society groups) continue to perceive the participation procedures as little more than uni-directional communication, the state institutions run the risk that once again civil society will distrust the entire process. In fact, the level of participation remained below expectation due to the withdrawal of NGOs such as the German Federation for the Environment and Nature Conservation (BUND) in the middle of the process in 2021, and low public interest in the first Beteiligungskonferenz in May

⁷For further details of all phases and steps, see the website of the operator BGE, <https://www.bge.de/de/endlager suche/standortauswahlverfahren/>.

2022. Amongst the 300 participants from various stakeholder groups, only a little more than a dozen citizens took part in the event (BGE 2022).

Alongside the existing economic and technical problems, the root of the current difficult siting process is the way the various governments managed the siting process in the past. Consequently, politics and policies continue to be constrained by past development paths and events and stakeholders that have shaped this past. This continuity and persistence, combined with uncertainty and a long timeline are part of the difficult socio-technical challenges facing the siting process. In addition, the present development is characterised by the fact that as of December 2022, half of the area of Germany could still be suitable for siting, and therefore there is not yet a directly “affected” population. Yet, in the course of recent years, there have been changes within the state institutions and among civil society actors. Institutions are learning how important it is to take the concerns and fears of the potentially affected population and interest groups earnestly and give them a voice. This increases the chances for a debate that is taken seriously by all parties and can thus potentially lead to “acceptable” results. Moreover, the participation of younger generations as new actors in the process might open-up a new window of opportunity.

The site search process is proceeding along the trajectories of the StandAG, which defines the tasks for the involved actors and specifies all key criteria and requirements. Although the ongoing process is experiencing a stall, potentially there is some room for manoeuvre. Whilst the intention of the legislator was ground-breaking and forward-looking, the StandAG (2017) leaves extensive space for interpretation, and therefore implementation. The fact that the law leaves many issues open should not be considered as a flaw, but on the contrary as an opportunity to reflect on the success or failure of the current participation procedures and to influence the process towards an acceptable solution. It remains to be seen to what extent and with which formats the participation of interested people will be enabled.

Hocke and Brunnengraber (2019) have pointed out that more attention should be paid to the different national, regional and local levels of action. Novel forms of multi-level governance must be developed and implemented to ensure that the knowledge and concerns of civil society are actually listened to, taken up and integrated into state-driven and -steered processes. Initiatives at regional and local level are now forming and they demand a role and a voice in the process. For the next steps in the site selection procedure envisaged by the legislator, i.e. the Regional Conferences and the Council of the Regions (see Fig. 5.4), more far-reaching participation formats could be developed and coordinated. Further elements of a bottom-up approach could be integrated into the procedure.

In spite of the progress made, the DGD issue will remain a thorny matter for at least a century. We have learnt that a generally acceptable procedure depends on trust and willingness within civil society to cooperate with the state. Fairness and inclusiveness of the process remain important and necessary prerequisites for confidence-building, and for the acceptability of the siting decisions. Ultimately, even if the state actors (BASE and BGE) are perceived as independent, competent and credible, new forms of participation, and dialogue on an equal footing, remain key. The participation processes initiated in the first of the three phases of the site selection represent an initial step towards a potential historical course-setting, through which the “hard nuclear state” and the social polarisation of past decades can be overcome.

Despite all the criticism of the first phase of the site selection and the need for improvement, the fulfilment of this possibility is linked to the clarification of many downstream issues concerning state intervention in the process. At the same time, it is necessary to master a balancing act in the design of participation corridors. Whilst participation should be thematically focussed on the final disposal in order to do justice to complex challenges, it is paramount to open up new arenas for a transparent discourse. This challenging task needs to be mastered before phases II and III of the selection process begin.

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Maria Rosaria Di Nucci is an energy economist and a senior researcher at the Department of Political and Social Sciences, Freie Universität Berlin. Currently she is the principal investigator of the Horizon 2020 research project COME RES on community energy. Previously she coordinated a Horizon 2020 project on acceptance of wind energy and cooperated in the project TRANSENS: “Transdisciplinary research on the management of high-level radioactive waste in Germany”, and other projects on nuclear waste governance (ENTRIA and SOTEC-radio). She is co-editor of a number of volumes on nuclear waste issues and authored several articles on nuclear waste governance. Rosaria’s research interests comprise: Multi-level governance, regulation of energy markets, comparative nuclear and energy policy and politics, support instruments for renewable energy, acceptance of contested technologies.

Achim Brunnengräber is a political scientist and an Associate Professor at the Department of Political and Social Sciences, Freie Universität Berlin. At the Research Center for Sustainability (Forschungszentrum für Nachhaltigkeit, FFN) he presently coordinates the research project TRANSENS: “Transdisciplinary research on the management of high-level radioactive waste in Germany” (transens.de). Additionally, he was engaged in other projects on nuclear waste governance (ENTRIA and SOTEC- radio). He is co-editor of a number of volumes on nuclear waste issues and has authored numerous articles on nuclear waste governance. His research and teaching interests comprise: Global governance, multi-level governance and socio-ecological transformation. His special focus is on nuclear policy, national, European and global energy, environmental, renewable and climate policy and politics.

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