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Summary

Report of the German Commission on the Storage of High-
Level Radioactive Waste
July 2016

PART A: SUMMARY AND RECOMMENDATIONS

This summary presents the main conclusions agreed upon by the Commission on the Storage of High-Level Radioactive Waste in its consultations, and its recommendations in condensed form. In view of the complex nature of the topic, agreement in this case does not mean that every formulation and every observation is equally and fully supported by each individual member of the commission. The full-length recommendations and conclusions of the commission's work presented in Part B of this report are authoritative.

1 REPOSITORY SITE WITH THE BEST-POSSIBLE SAFETY

Radioactive waste must be disposed of in a way that poses no short, medium or long-term risks to mankind and the environment. Safety is the overriding priority for the commission. In view of the long half-life of some radionuclides, safety needs to be ensured for a period of one million years. The extremely long duration of the challenge to keep radioactive waste away from the Earth's biosphere is the dominating factor in the search for responsible disposal options. The principle of sustainability, which the commission has committed to in its guiding principles, requires this search to be aligned with the ethical criteria of equity, fairness and responsibility towards future generations.

The commission has learnt lessons from the past and defined goals for the path to safe disposal on this basis. These goals are the greatest possible reversibility of any decisions made and the implementation of the site selection procedure in transparent dialogue with the public. The principle of reversibility arises, on the one hand, from the wish to leave options open to correct mistakes in the event of unexpected developments and, on the other, from the ethical principle of keeping open or opening up options for future generations. The participation of the public in accordance with clearly defined rules and rights is required to generate trust in the procedure and to take account of as many perspectives as possible in the search for the site with the best-possible safety.

Pursuant to Section 1(1) of the Repository Site Selection Act (StandAG), the "objective of the site selection procedure is to identify the site for a repository of domestically produced radioactive waste, particularly high-level radioactive waste ... that delivers the best-possible safety for a period of one million years". The implementation of this goal was the commission's central challenge.

The task of determining the site with the best-possible safety needs to be accomplished in a site selection procedure. This procedure and its individual steps and decision-making criteria must be structured in such a way that the outcome of the search for the site with the best-possible safety is transparent and comprehensible.

Short, medium and long-term safety is utmost in this procedure, and takes priority ahead of all other considerations. The site selection procedure must identify the best-possible site according to safety aspects, while also observing the other goals of reversibility and public participation.

2 STARTING CONDITIONS FOR SITE SEARCH

When the last nuclear power plant is switched off in Germany by 31 December 2022 at the latest, almost no more high-level radioactive waste will be produced in the country. There will then be around 30,000 cubic metres of high-level radioactive waste requiring final disposal. Until that point, the use of nuclear power in Germany will have produced irradiated fuel elements with a nuclear fuel content of around 17,000 tonnes. This already includes irradiated fuel elements with around 850 tonnes of nuclear fuel that will be used in the nuclear power plants currently still in operation during their remaining service lives.

The total volume of low-level and intermediate-level radioactive waste to be disposed of in Germany could reach 600,000 cubic metres, twenty times more than the volume of high-level radioactive waste. However, the high-level radioactive waste contains around 99 percent of the radioactivity. The vastly stronger radiation emitted by high-level waste and the considerable heat it generates makes its safe final disposal an extremely challenging task.

However, part of the low and intermediate-level radioactive waste was relevant to the recommendations of the commission. At present, there is no option for disposing of the mix of radioactive waste and salt to be retrieved from the Asse mine, which could amount to as much as 220,000 cubic metres. There is also no option to date for the final storage of the waste from uranium enrichment which amounts to up to up to 100,000 cubic metres according to Germany's national programme for the responsible and safe management of spent fuel and radioactive waste¹ and for more than 6,000 cubic metres of intermediate and low-level radioactive waste that is not suitable for the Konrad mine.² The commission therefore also investigated under what conditions it would be possible to finally dispose of this waste in the same site as the high-level radioactive waste.

2.1 Lessons learned from the past

The commission was tasked pursuant to the Repository Site Selection Act to propose a scientifically-based procedure for selecting the site for the final disposal of high-level radioactive waste that delivers the best-possible safety. A further part of its mandate was to evaluate the experiences made so far, decisions reached and existing regulations on the management of radioactive waste.

The Repository Site Selection Act includes measures to address the difficulties encountered by previous final disposal initiatives in Germany. It terminated the exploration of the Gorleben salt dome and called for a new search for a final repository site for high-level radioactive waste in particular. The commission learned lessons from previous final disposal efforts in Germany, reflected on the cultural and social contexts requiring consideration in reaching a new understanding and took account of the continuous further development of the science and technology of final disposal.

The multi-phase, open-ended procedure on selecting the final repository site that deliver the best-possible safety is the most important and logical consequence of the conflict-ridden final disposal efforts seen in Germany in the past. The procedure presents an opportunity to overcome past conflicts and reach a new understanding. This kind of site selection procedure prevents a premature commitment to a site before its exploration has been completed. Right up until the final decision is made, different sites will be investigated in parallel with increasing intensity, with the ultimate choice, based on safety aspects, being kept open until the end. The selection procedure is therefore open-ended and cannot be suspected of merely being used to confirm prior assumptions or a politically motivated decision on a site.

The geoscientific criteria elaborated by the commission in this report will guide the comparative selection process.³ This means that the criteria used to select a site with the "best-possible safety" have already been defined before the selection process begins. This is also a lesson learned from Gorleben.

¹ According to the Federal Environment Ministry (BMUB), the figure of 100,000 cubic metres of waste from uranium enrichment provided in the disposal programme is derived from a calculation that is based on 40 years of operation. The uranium enrichment plant in Gronau has an unlimited operating licence. URENCO Deutschland GmbH, the nuclear fuel company operating the plant, however, wrote to the commission saying that the volume of waste would only reach 100,000 cubic meters by the end of the century.

² Cf. section B 2.3 "Waste balance" and B 6.6 "Requirements for the emplacement of further radioactive waste".

³ Cf. section B 6.5 of this report "Decision-making criteria for the site selection procedure".

An argument often used against the exploration of the Gorleben salt dome was the accusation that the site had been selected for political reasons. Politics will also play an important role in the new procedure. The Repository Site Selection Act stipulates that the German Bundestag shall make a decision after every phase of the multi-phase selection procedure to confirm that the proposed selection decision in each case is based on the correct application of the criteria and that the general public was involved. Following public debate, the parliament will approve and endorse the outcome of the scientifically-based selection procedure in each instance. This procedure is thus not comparable with the internally prepared cabinet decision that led to the announcement of Gorleben as a repository site.

The search for the site with the best-possible safety starts with a “white map” of Germany. This means that the procedure will include all potentially suitable host rocks and all potentially suitable sites in order to avoid pre-designations that could be regarded as irrelevant to the real priorities. The commission formulated selection criteria without any specific sites in mind. The criteria apply as far as possible to all rock types that are theoretically suitable for hosting a final repository. A selection will not be made on the basis of political expediency.

In the exploration of the Gorleben salt dome, official public participation was only provided for in the plan approval procedure required for all major projects that would have ensued following a positive outcome of the exploration. This fuelled suspicion among critics that the affected citizens were to be presented with a *fait accompli*. Here, in contrast, the commission is recommending a selection procedure that grants the public extensive options for participation and involvement at an early stage. With this approach in mind, the commission has elaborated a comprehensive concept for public participation in the site selection procedure that sets out public participation rights, forms of participation and options for redress in detail.⁴

New forms of participation and influence by the population also require a change in conduct on the part of the public authorities. They must involve critical or protesting citizens and treat them with respect at all times. The new site selection will only be successful if all parties are prepared to learn from the past and are willing to behave in a way that allows a new level of trust to develop and open discussion of all problems. The public authorities involved must help make this possible through transparency, in other words, by always disclosing the reasons for planned decisions in detail and in good time, and by facing any criticism from citizens in a prompt manner. Criticism levelled at the actions of public authorities is often a chance to remedy weaknesses.

However, the commission does not believe that it will be possible to implement the final disposal of high-level radioactive waste without conflict and has consequently drafted rules and recommendations on dealing with conflicts.⁵ It also firmly believes that a far-reaching ethical approach to the future needs to be anchored in the political arena and society.⁶

The commission believes that the purpose of the future site must be clear before the selection procedure begins. The commission has deliberately geared its selection criteria towards the requirements of the best-possible final disposal of high-level radioactive waste. It believes that the disposal of low and/or intermediate-level radioactive waste at the same site is only possible if negative interactions with the high-level radioactive waste can be ruled out.⁷ It nonetheless recommends taking account of this option from the outset in the public participation process.⁸

The general population must know, right from the beginning, what they could be facing. Two years after Gorleben was named as a nuclear storage facility, the federal government and the

⁴ Cf. section B 7 of this report “Site selection in dialogue with the regions”.

⁵ Cf. section B 2.4 of this report “Principles for dealing with conflict in participatory search procedures”.

⁶ Cf. section B 3 of this report “The principle of responsibility”.

⁷ Cf. section B 6.6 of this report “Requirements for the storage of further radioactive waste”.

⁸ Cf. section B 7 of this report “Site selection in dialogue with the regions”.

state government of Lower Saxony mutually agreed to change the main purpose of the site from a nuclear storage centre to a location to be explored as a final repository of nuclear waste.

The commission believes that changes should be made in light of the failed final disposal of radioactive waste in the former salt mine Asse on how to deal with divergent scientific opinions. Early warnings of water inflows in the Asse mine were ignored and even had negative consequences for the reporting scientists. In the case of the Asse II mine, corrections to the path being taken could have been made at an earlier stage if critical voices had been taken seriously. The later a mistake is recognised as such, the more costly is its correction. The case of Asse also shows the absolute necessity of obtaining an expert opinion that is independent of the operator.

It must be said, however, that valuable experience was gained through the Asse Advisory Group that should be applied in organising public participation in major projects in the future.⁹ From today's point of view, the commission recommends designing the entire final repository procedure as a self-reflecting system and to avoid mistakes and undesirable developments as far as possible through constant process monitoring.¹⁰

The Commission on the Storage of High-Level Radioactive Waste recommends making the changes outlined above based on Germany's past experience with final storage in order to reach a new, mutual understanding that will make it feasible for an open-ended procedure to lead to a fair and transparent solution with the best-possible safety.

2.2 Mandate and working methods of the commission

The Commission on the Storage of High-Level Radioactive Waste was tasked with preparing the selection of a site that provides the best-possible safety for a period of one million years for the disposal of high-level radioactive waste in particular. To do so, the commission has critically reviewed the rules stipulated for the site selection procedure in the Repository Site Selection Act. It has elaborated criteria for the site selection, proposals for public participation in the site selection procedure, and proposals for the site selection process and for organising the same. It has thus developed a criteria-based selection procedure that can be used to select the site with the best-possible safety while providing scope for a correction of mistakes. On the basis of its proposals on these main tasks and its further tasks as set out in the Repository Site Selection Act, the commission has formulated recommendations to the Bundestag, the Bundesrat and the federal government that should now be implemented by amending the legal provisions or through administrative action.

In its rules of procedure, the commission commits to working in a transparent way and gives its members broad minority rights. In line with its transparency objective, the sessions of the commission itself and its working groups and ad-hoc groups were open to the public as a general rule. The commission sessions were broadcast live on the German parliament's TV channel and on the internet, and video recordings of the sessions were then made available on the commission's website. Audio recordings of the working group and ad-hoc group sessions were also available for download on the website. All relevant consultation documentation, to the extent possible without breaching third-party rights, was also made available to the public on the website in the form of commission printed papers and commission material. The commission also set up an internet forum in spring 2015. The commission closely involved interested citizens and representatives of civic groups in its work through numerous dialogue

⁹ The Asse II Advisory Process is the overarching term for the concerted and differentiated approach of various state, political and civil society bodies with the objective of achieving regional and civil society participation and process transparency in the legally stipulated retrieval of radioactive waste from the former Asse II mine (Wolfenbüttel county). The advisory process is primarily organised by the Asse II Advisory Group (a2b). The advisory process is financed by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety.

¹⁰ Cf. section B 6.4 of this report "Structuring process as self-reflecting system".

events ranging from a “citizens’ dialogue on site selection” to a public discussion on the draft of the commission’s report.

Following on from the provisions of the Site Selection Act on the commission’s work and the decision taken by the German Bundestag with a large majority to establish the commission,¹¹ it emphasised the desire to reach consensus. The commission endeavoured to reach a “mutually agreed solution to all questions, as the success of the commission’s work ultimately depends on reaching a broad-based consensus”,¹² as it says in the rules of procedure. This final report, which was approved by the commission with an overwhelming majority, achieved this self-defined objective. The fact that the report only has a few dissenting opinions is testament to the broad consensus reached and that it makes its recommendations unanimously.

3 RECOMMENDED OPTION: FINAL DISPOSAL WITH REVERSIBILITY

Following an in-depth review of a number of options for the final disposal of high-level radioactive waste in particular, the commission recommends disposal in a purpose-built mine in a deep geological formation. A new aspect of this concept is the factoring in of ethical principles regarding future generations and viewing the issue as a learning process. This entails providing for the reversibility of decisions taken in order to have the widest possible scope to correct mistakes and thus reach the objective of the best-possible safety.¹³ Reversibility, in other words, making provisions to allow for reversal or a modified path to be taken during the course of the procedure, is needed to allow mistakes to be corrected, to leave scope for action for future generations – for example to take account of new scientific knowledge – and can help to build trust in the procedure. Concepts for the retrievability or recovery of the waste that enable the reversibility of decisions are central here.

3.1 Bases of the recommendation

Pursuant to the guiding principles of the commission, the framework conditions stipulated in the Repository Site Selection Act and ethical considerations, the path towards safe final disposal must meet the following requirements:

- The search for the disposal path, final repository site and concept must be primarily directed towards the goal of finding the safest form of disposal of high-level radioactive waste in particular given what we know today: safety takes precedence.
- The radioactive waste produced domestically must be placed in safe final storage in Germany.
- The form of disposal must be designed in such a way that it does not place a permanent burden on future generations but, rather, provides for a safe final condition for the disposal of all high-level radioactive waste.
- The solution must allow for the option of a decision to deviate from the option recommended here. It must be possible to correct mistakes. Unnecessary irreversibilities must be avoided. Before irreversible decisions, or decisions that can only be revised at

¹¹ Cf. the motion of the CDU/CSU, SPD and ALLIANCE 90/THE GREENS parliamentary groups “Establishing a Commission on the Storage of High-Level Radioactive Waste – Taking on responsibility for future generations”, Bundestag printed paper 18/1068.

¹² Cf. section 3 of commission’s rules of procedure. See the annex to this report Section B 12.2.3.

¹³ Cf. section A 1 of this report.

great expense and effort, are taken, a transparent and scientifically validated evaluation must be carried out with the participation of the public and the relevant committees.

- The whole process must be transparent, with significant participation of the public and the regions affected and must be designed as a self-reflecting system.

An outline of the option recommended by the commission is presented in the following section. Its implementation via specific process steps and the application of decision-making criteria is addressed in the following chapter.

Brief definition of some terms: stages, phases, steps, BGE and BfE

*This report describes the entire process of the final disposal of high-level radioactive waste. The selection of the site for the repository is only the first **stage** and will be followed by several further stages including the construction of the repository, the final storage itself and the sealing of the mine. The site selection procedure consists of three **phases**: the selection of possible regions for the site, surface exploration and underground exploration. Phase 1 of the site selection procedure is planned to consist of three **steps**. Site selection and then later final disposal will be tasks for the **BGE (Bundes-Gesellschaft für kerntechnische Entsorgung)** a federally-owned company that is to be set up and will take on the role of implementing agency. The BGE will be monitored by the regulatory authority **BfE (Federal Office for the Safety of Nuclear Waste Management)**. The BfE will also organise the participation of the public in the site selection.*

3.2 Statement of grounds for the recommendation

In the early days of nuclear power, the problem of the disposal of high-level radioactive waste received little attention. Optimism prevailed that a solution would surely be found in time. Early opinions in this debate on the options for disposal included the propagation of ideas that now seem extremely naive given the challenges involved. Storage in underground caverns, dissolving and diluting the waste in the waters of the oceans, or simply trust in technical progress that was expected to provide technical solutions to the problem of disposal dominated considerations on how to manage radioactive waste. It was only in the course of time that it became clear just how big the scientific, technical and also societal challenge of the safe, fair and peaceful management of such waste actually is.

The objective of keeping radioactive waste away from the Earth's biosphere also led to considerations of disposing of the waste in space, in the depths of the Earth's crust – in deep boreholes at depths of 3,000m or 5,000m for example – in the deep sea or in the Antarctic or Greenland ice sheet. Another group of options was based on the factor of time, in other words on finding an interim solution for several centuries in the expectation that new solutions would have been found by then. Transmutation, i.e. the conversion of long-life radionuclides into less long-life radionuclides, is expected to at least simplify the problem of disposal. Options for disposal in mines in deep geological formations can be differentiated according to their degree of reversibility and range from a rapid and practically irreversible sealing up to securing the retrievability of the waste over longer periods of time and its recovery after the mine has been sealed.

The commission investigated these options intensively. The main reasons of the commission for recommending the presented option of “final repository mine with reversibility” to the German Bundestag are as follows:

- In the opinion of the commission, disposal in a deep geological formation is the only option with a chance of providing a permanent and safe disposal of radioactive waste for the required period of one million years. The long-term reliability of the sealing function and the integrity of the safety-bearing geological properties can be scientifically proven by empirical research and modelling.
- In contrast to above-ground or near-surface disposal, geology provides passive safety after a certain point in time and does not then require any further maintenance.
- It is not possible to rely to the same extent on stable social structures that can maintain the radioactive waste stored close to the surface over the long term.
- The option “final repository mine with reversibility” can be feasibly implemented in Germany in a foreseeable period of time. The technical prerequisites such as containers, building and operating the final repository mine, storage and sealing are all held to be feasible by the commission.
- From a certain point in time, this option will liberate future generations from the burdens of radioactive waste, unlike near-surface permanent disposal, for example.
- The option “final repository mine with reversibility” allows for a high degree of flexibility to apply new knowledge. The option of changing to a different disposal path remains available for a long time during the procedure.
- This option enables lessons to be learned from the previous process steps and mistakes to be corrected, for example through monitoring.
- Extensive scientific knowledge is available about the required geological prerequisites, which makes implementation seem promising.
- The commission believes that the option “final repository mine with reversibility” corresponds most closely to its guiding principles and is the most promising path for the responsible management of high-level radioactive waste in Germany.

The commission is aware that the final disposal of high-level radioactive waste is necessarily a long-term process. It is nonetheless of the opinion that everything possible needs to be undertaken to rapidly implement the repository.

3.3 The path to safe final disposal

Within the specified framework conditions, there are various conceivable ways of implementing the commission’s recommended disposal path “final repository mine with reversibility” in concrete detail. The next generations are of course free to decide on the details of the final disposal themselves.

The commission’s recommendation of a “final repository mine with reversibility” envisages the construction of a final repository in a purpose-built mine in a deep geological formation. This is to be sealed in the more or less distant future and not cause any burdens to the populated environment or to future generations. All the steps on the path towards this state must be plausibly presented at the beginning of the process in order to explain why this path is expected to provide a sustainable, responsible and safe solution to the management of high-level radioactive waste. The following outline is designed to show how the path can be broken down into stages from today’s perspective. By illustrating the whole process right up to completion,

the outline serves to review the plausibility of the various sub-processes and the feasibility of the demand for reversibility.

Stage 1 - Site selection procedure: The site selection procedure will be initiated by decision of the German Bundestag. What is required, above all, are clearly scientifically defined and democratically legitimated selection criteria and safety standards, and clear rules on procedural steps, public participation, public authority structures and decision-making processes. The selection of the site will take place in several steps that gradually narrow down the potential regions and sites until the site has been identified that offers the best-possible safety. During this process, the high-level radioactive waste will continue to be stored in interim storage facilities. In case the selection of the site for final disposal takes an unexpectedly long time or a decision is made to change to a different path, it may become necessary to initiate technically, economically and institutionally complex processes for the safe interim storage of the waste. This stage is completed by a decision of the German Bundestag laying down the site of the repository.

Stage 2 - Mining development of the site: The mining development of the site for the disposal of radioactive waste initially comprises the planning and approval process that is required pre-development and provision of the necessary proof of long-term safety comprising both geological barriers and the technical concept for final disposal. The next step is the construction of the repository including all the required surface and underground technical facilities including the transport routes for later emplacement. During this stage the development can be broken off at any point and alternative disposal paths can be taken.

Stage 3 - Emplacement of radioactive waste in the repository mine: The emplacement of radioactive waste begins when the first loaded final disposal cask is brought into the prepared mine. The final disposal casks will be stored in a row of chambers, in galleries, or in boreholes leading off from the galleries, depending on the selected final disposal concept. As soon as one of these storage units has been filled, it will be backfilled to seal off and isolate the finally disposed waste from the mine and, in particular, from the people working there. The backfilling will be carried out in a way that makes it possible for the units to be reopened and the waste stored there to be retrieved in accordance with an available technical concept over an appropriate period of time, which in this case is a period of time similar to the intended duration of the storage. The casks/containers also need to be designed in a way that allows for their retrieval. The mine itself will be maintained in an operational state during this stage. The emplacement of the waste can be interrupted at any time and continued at a later date, or can be broken off entirely. It is still possible to change to a different disposal path at this stage as the mine is still functional. The waste that has not yet been emplaced would then remain in the interim storage facilities with corresponding safety standards. The emplacement is completed when the last filled final disposal cask has been placed in the mine.

Stage 4 - Observation prior to sealing of the repository mine: During this stage the mine remains fully functional and accessible. The further development of aspects such as temperature, the stability of the geological formation and gas formation is monitored. The objectives of the monitoring process should be defined as early as possible. The emplaced casks remain in the mine but can still be retrieved if necessary. At this stage, too, the process can still be broken off and a different disposal path taken. In this case, the emplaced waste would have to be retrieved and brought to a safe location above ground. The sealing of the repository mine marks the end of this stage.

Stage 5 - Sealed repository mine: The sealed repository mine marks the attainment of the goal of a safe and maintenance-free containment of radioactive waste in the mine. The sealed repository mine can continue to be observed from the outside. The extent to which activity inside the mine can continue to be observed will depend on the monitoring measures provided

for in the course of emplacement or in the phase prior to sealing the mine. If required, the casks can be retrieved by opening up a new mine and using the available documentation. Retrieval and recovery are possible as long as the location of the repository mine is known, the documentation is still available and legible, the final disposal casks, the containers, themselves are in a recoverable state, and the technical and societal conditions necessary for a recovery, i.e. for opening up a parallel mine, are given.

This option combines the goal of safe and maintenance-free final disposal with the wish for reversibility of decisions, retrievability of waste, and scope for correcting mistakes and to learn during the process. At least until the end state of the disposal path designed in accordance with these requirements has been reached, precautions need to be made to put in place a permanent monitoring of the disposal process in terms of safety, transparency and participation.

Suitable forms of monitoring are required in order to recognise the need for process modifications and the need to correct mistakes in the first place. This applies in particular to decisive steps in the disposal process and also to decisive changes in society. The time required until a site has been selected, the waste has been emplaced and the repository mine has been sealed is difficult to estimate at this point in time. Delays in the process, legal disputes, changes to the plan and setbacks can all mean that the time spans required will stretch far into the future.

Very long periods of time would however significantly burden the next generations, would make extensive interim storage with corresponding safety standards and approval procedures necessary, would harbour the risk of flagging and fatigue, and increase the risk that the whole process will not be brought to a satisfactory conclusion. Given the ethical standards the commission has set itself, efforts must be made to keep the timeframe for the entire process within reasonable limits. Regarding the conflicting goals of best-possible safety and substantial public participation on the one hand, and the wish to keep the time period for the process as short as possible on the other, the commission takes the following position:

- A rapid realisation of the final disposal of high-level radioactive waste is important. Safety and participation nonetheless remain a priority; considerations here must also take account of the issue of interim storage.
- The implementing agency should develop a framework time schedule with key dates and milestones early on in the site selection procedure.
- All parties involved in the procedure are called upon to optimise the site selection procedure and the construction of a final repository in order to implement it rapidly, and to structure project implementation as time-efficiently as possible.
- The various steps of the procedure should, wherever possible, be carried out in parallel.
- Research should be promoted to develop proposals on how to shorten time-intensive processes such as underground exploration.

The site selection procedure scheduled to start in 2017 must take into consideration all aspects relevant to all stages up to a sealable repository mine. This applies in particular to laying down the decision-making criteria and the process steps that will lead to the selection of the site with the best-possible safety.

4 THE PATH TO FINDING THE SITE WITH THE BEST-POSSIBLE SAFETY

Selecting the site with the best-possible safety as the outcome of a scientifically-based, criteria-guided transparent and participatory process places high demands on the procedure. This

section briefly describes the selection procedure¹⁴ and then introduces public participation¹⁵ and the decision-making criteria¹⁶ as key elements of the recommendations of the commission to the legislator.¹⁷

4.1 The site selection procedure

Once the Repository Site Selection Act is amended by the Bundestag and the Bundesrat on the basis of this report, the selection procedure for the site of a repository for high-level radioactive waste can commence. An important component of the procedure are the actors, process steps and decision-making criteria referred to in the Repository Site Selection Act on the basis of the commission's recommendations.

As stipulated in the Repository Site Selection Act, the commission has divided the site selection procedure into three phases. In each phase, the implementing agency submits a report on the results achieved thus far and the path taken to reach them. The report will then be reviewed by the BfE (Federal Office for the Safety of Nuclear Waste Management). It will also be discussed and consulted on with public participation, scientists and finally by the German Bundestag and Bundesrat. On the basis of the outcome of this process, the Bundestag and the Bundesrat will then take a final decision about entering the next phase of the site selection procedure.

Table 1: Phases of the site selection procedure

Phase	Tasks	Completion
One	Start with a “white map” of Germany. Exclusion of regions based on the agreed exclusion criteria and minimum specifications. Comparative analysis on the basis of the existing data ¹⁸ by applying the assessment criteria and the representative preliminary safety analyses.	Decision by the German Bundestag and the Bundesrat on surface exploration of possible site regions.
Two	Surface exploration of the possibly suitable site regions identified in phase 1. Comparative analysis and assessment according to the agreed exclusion criteria, minimum specifications and assessment criteria and further developed preliminary safety analyses.	Decision by the German Bundestag and the Bundesrat on underground exploration of possible site regions.
Three	Underground exploration of the sites selected as the outcome of phase 2. In-depth investigation with respect to the requirements for safe final disposal. Extensive preliminary safety analyses. Comparative assessments between the possible sites with the aim of identifying the site with the best-possible safety.	Determination of the repository site by the German Bundestag and the Bundesrat.

In phase 1, the implementing agency will work on the basis of geological data and information that is held or can be obtained by the geological authorities in Germany. In the first phase, the available information is gathered and extensively analysed. No further geological data will be collected through exploration at this point. It may become necessary to collect additional

¹⁴ Cf. section A 4.1 of this report.

¹⁵ Cf. section A 4.2 of this report.

¹⁶ Cf. section A 4.3 of this report.

¹⁷ Cf. section A 5 of this report.

¹⁸ As well as any additional data collected.

information¹⁹ if the directly available information and knowledge is not sufficient for an evaluation, and deeper analysis of the raw data would lead to additional findings.²⁰

In the first phase of the site selection procedure, starting with the whole territory of the Federal Republic (a white map of Germany), the sites for subsequent surface exploration will be identified in three steps. In step 1, those regions are excluded where, based on the geological exclusion criteria and the minimum specifications, final disposal does not appear feasible from the outset.²¹ The remaining regions are then narrowed down further in step 2 through application of the geological assessment criteria on a large number of potential regions and sites. An in-depth geoscientific assessment then follows in step 3 in which the geological assessment criteria are again applied and combined with the results of the representative preliminary safety analyses. After that, planning science assessment criteria²² are applied. This will further narrow down the subregions that have been identified as potentially suitable in terms of safety aspects to those that are also acceptable in terms of planning law.

At the end of step 2, the implementing agency will submit an interim report on the identified subregions. This report will be discussed in the context of a subregions expert conference²³ while the implementing agency continues its work. The implementing agency's report on phase 1 with the proposal for potential subregions, the corresponding preliminary safety analyses and the proposal for a selection of site regions for surface exploration based on these investigations will then be submitted to the BfE and published. This report shall contain a detailed presentation on how the conclusions were reached by providing transparent documentation and reasons for all steps taken and decisions made. The report only represents the proposal of the implementing agency and is not yet the outcome of the first phase.

Once the report has been submitted, it will be subjected to scientific review and public debate using the channels of public participation provided.²⁴ The Bundestag and the Bundesrat will decide the potential sites for surface exploration, taking the results of the participation process into account.

At the beginning of phase 2, surface exploration will be carried out on the selected potential sites. The implementing agency will then analyse the results of the surface exploration and on this basis further develop the preliminary safety analyses. The exploration works will be carried out pursuant to the site-specific exploration programmes defined by the BfE.²⁵ The population in the regions where explorations are being carried out will be given the opportunity to get involved on a regular basis through regional conferences and other formats.²⁶

The findings gleaned from the exploration and further development of the preliminary safety analyses will then be analysed by the implementing agency in relation to their environmental compatibility and any other possible impacts of final repository mines. The implementing agency will then compile a report on this basis providing the BfE with a proposal for the expert site selection of the host rock types to be included in the further exploration. The proposal will also contain elaborated programmes for underground exploration. In the opinion of the commission, this report should also already contain the proposals for an in-depth geological exploration programme and for site-specific test criteria and the documentation required for regional development appraisal.

¹⁹ Additional data collection can include a more detailed or renewed evaluation of available geological raw data or of existing drill cores. Cf. section B 6.5.8 of this report.

²⁰ Cf. section B 6.3.1.1 of this report.

²¹ Cf. section A 4.3 of this report.

²² Cf. section B 6.5.9 of this report.

²³ Cf. section A 4.2 of this report.

²⁴ Cf. section A 4.2 of this report.

²⁵ Cf. section B 6.3.1 of this report.

²⁶ Cf. detailed presentation in sections B 7.4 and B 7.5 of this report.

The implementing agency's report shall contain a detailed presentation on how the conclusions were reached by providing transparent documentation and reasons for all steps taken and decisions made. Once the report has been submitted to the BfE, it will be subjected to scientific review and public debate. Finally, the Bundestag and the Bundesrat will decide the potential sites for underground exploration, taking the results of public participation and the tests into account.

In phase 3, the implementing agency itself undertakes the underground exploration of the potential sites. It subsequently submits a report on the findings of the exploration and its conclusions to the BfE. This report shall contain a detailed presentation on how the conclusions were reached by providing transparent documentation and reasons for all steps taken and appraisals made. During its review of the report, the concluding comparative analysis of the sites and the elaboration of a site proposal, the BfE will at the same time involve the public. In contrast to phases 1 and 2, the implementing agency will not make a proposal for a site in this case. In phase 3 this is the task of the BfE. The final step of phase 3 is the decision on the site by federal law. This marks the transition to stage 2, the mining development of the site. This commences with the approval procedure pursuant to Section 9b of the Atomic Energy Act.²⁷

The exclusion criteria, minimum specifications and assessment criteria as well as the requirements set down for the safety analyses recommended by the commission apply to all phases of the site selection procedure. They are applied from phase 1 to phase 3 in ever increasing detail and with increasingly precise data, from already available data in phase 1 to additional data obtained from surface exploration in phase 2 up to the data from underground exploration in phase 3. The path that leads from the white map of Germany to the identification of the site with the best-possible safety will thus be taken step by step.

In this way, the site selection procedure will be navigated towards the site with the best-possible safety using the set of defined criteria, while the monitoring of the adequate application of the criteria, in particular the assessment criteria, is carried out within the procedure itself. This is an unprecedented approach which the commission regards as ambitious but feasible.

4.2 Participation of the public

4.2.1 Challenges and bases

The proposed participatory selection process is entering uncharted territory on several key topics. It is tackling a highly complex issue that has experienced a hugely conflict-laden past over the last few decades, with the objective of finding a solution that is based on broad social consensus and can ultimately also be tolerated by the immediately affected population.

This goal can only be reached if all parties are involved in a fair and unprejudiced manner throughout the entire procedure. However, they must also be prepared to engage in a new culture of social conflict that takes heed of the conflicts of the past and addresses newly emerging conflicts but is also guided throughout by a constructive attitude to conflict and does not lose sight of the common goal of reaching a solution that is socially viable and as consensual as possible.

This will require a truly participatory site selection procedure that takes equal account of the historically conflict-laden situation, the complexity of the issues involved, and the expected duration of the procedure of several decades. Comprehensive participation is the basic foundation of a procedure that will increase the quality, legitimacy and acceptance of both the process and the outcome through public involvement. It regards citizens as emancipated co-

²⁷ Cf. section A 3 of this report.

shapers of the procedure and thus takes account of all the dimensions involved in successful participation.

This approach to the task in hand leads to the following key basic requirements in shaping participation in the site selection procedure:

- **Transparent information policy that is both wide-reaching and deep:** Information and transparency in all steps of the site selection procedure are elementary prerequisites for successful participation. Information must be provided in the necessary depth for the professional public and interested citizens. At the same time, efforts should be made to disseminate basic information about the issue of disposal and the process of selecting a repository site to as broad a public as possible.²⁸
- **Shaping the public interest with participation of the affected parties:** The site selection procedure is also particularly challenging in that it strives to reach an outcome that serves the public interest but depends on the tolerance of the affected persons in the site region to achieve this goal. To implement an approach that is oriented towards the public interest but does not force itself on the affected parties but rather shapes this perspective with their direct participation as far as possible will require offers of participation that go beyond the standards seen in infrastructure projects so far. The public interest perspective is the focus of the national support body.²⁹ The extensive participation of the affected parties will take place largely through regional conferences. Additional options for supra-regional participation³⁰ are designed to promote exchange between the regional conferences and encourage a change of perspective among the various actors. The communities living near the current interim storage sites will also be included in the supra-regional participation formats.
- **Successful participation through co-shaping and review:** In order to build trust in the fairness of the repository site selection procedure, the people involved must be provided with participation rights on two levels. First, they must be allowed to accompany and help shape the steps of the procedure. Second, they need clearly-defined monitoring rights that enable them to critically appraise and improve upon the quality of the process and the decisions being made, but do not entail the risk of endangering the whole process through blockades. For this purpose the commission envisages the regional conferences as described in detail in this report. Prior to each decision by the Bundestag, the regional conferences are given one opportunity, in the form of review rights, to point out deficits and to file a request for their remediation. The details on this are presented later in this report in the section on regional conferences³¹ and the section on the procedure on opinions and discussion meetings.³²
- **Joint development of future perspectives for the affected region:** The people who are ultimately affected by the repository site selection procedure will rightly expect a process that is as transparent as possible and includes the concerted elaboration of future perspectives for their region as one of its central components. This particularly includes the issue of shaping regional development potential, which must be carried out at an early stage, transparently and in dialogue with all affected actors in order to ensure that they are not disadvantaged and to provide the site region with long-term compensation. To this end we recommend the participatory elaboration of a site agreement.³³

²⁸ Cf. section B 7.3.4 and B 7.3.5 of this report.

²⁹ Cf. section B 7.4.1 of this report.

³⁰ Cf. section B 7.4.4 of this report.

³¹ Cf. section B 7.4.3 of this report.

³² Cf. section B 7.4.5 of this report.

³³ Cf. section 7.2.2 of this report.

- **Keeping on course with an adaptive and self-healing procedure:** The intensity, complexity, scope and duration of the repository site selection procedure make it an exceptional case in the history of our Federal Republic. The demands and also the risks of the associated process of participation are correspondingly high. From our current perspective and state of knowledge, it is not possible to foresee all of these demands and risks and incorporate them in our planning. We therefore recommend establishing a robust system of participation that is adaptive and self-healing, in which the real options for participation and the roles in the procedure are clearly defined and transparent for all those involved. This will be made possible primarily through the national support body³⁴ with the assistance of a commissioner for participation, the accompanying scientific evaluation and the iterative development of the participation design in direct dialogue with the citizens participating in the respective phases. This adaptive system of participation³⁵ is presented again in a compact overview at the end of this chapter.

4.2.2 Information and transparency

To enable successful participation, the parties that need to be involved should be provided with low threshold and extensive information at an early stage. Open access to information and the way it is presented plays an important role in ensuring the quality of participation.

A key element for the successful provision and dissemination of information is an independent information platform as already proposed in the AkEnd report (Working Group for the Selection Procedure for Final Repository Locations). The report particularly emphasises the importance of the independence of this medium; although it will be operated by the BfE as the implementing agency of public participation, it will also provide scope for other actors, including regional bodies and the national support body, to influence the contents of the platform. These actors should play an active role in generating, preparing and reviewing the information provided.

The information should be prepared in such a way that controversial issues are addressed from different perspectives and by different authors. Minimum scientific standards should be upheld.

Overall, the information should provide a balanced and comprehensive stock of information. The information and the access to it should be prepared and structured in such a way that non-experts, interested citizens with specialist knowledge, researching journalists, and experts from science and the private sector can all find a suitable level and style of information on this platform.

The regional bodies should take an active role in the development of the platform and its ongoing maintenance. They should be able to use the platform and the optional local information offices as tools to promulgate their consultation results to the regional public and receive feedback from the public. The national supporting body can also contribute contents.

The information should not just reach people who were already interested in the procedure from the outset. In line with the goal of activating broad interest on the issue it is important that a supra-regional information campaign is launched to accompany the procedure so that people who have not thought about this issue so far are also informed about the larger context of the repository site selection and the available options for participation.

To achieve an effective and useful kind of transparency, the following prerequisites must be fulfilled: knowledge that this information exists, access to the information, the ability to analyse the information and to understand its scientific and political context. The information platform provides access and the regional conferences are new institutions designed to develop the ability

³⁴ Cf. section B 7.4.1 of this report.

³⁵ Cf. section A 4.2.8 of this report.

to analyse the information and understand its scientific and political context in a responsible way.

The commission therefore recommends creating a public information register for the documents of the BDE and the BfE and to apply the experience gained with the Transparency Act of Hamburg (HmbTG) to this process.

4.2.3. National support body

The central tasks of the national support body are to provide mediating and independent support for the site selection procedure, and in particular for the implementation of public participation in the site selection procedure.

The national support body is an independent social entity vis-à-vis the public authorities, involved companies and expert organisations, which stands above the procedure, is characterised by its neutrality and expert knowledge and designed to maintain continuity of information and trust. The aim of the body is therefore not only to accompany the public interest perspective of the procedure but also to build and maintain continuity of trust between the various actors involved.

The national support body should take up its work immediately after the commission report has been submitted to avoid disrupting the social monitoring of the procedure and to maintain the social dialogue. It will therefore be appointed in two stages:

- The national support body shall be composed of nine members from its establishment up to the completion of the evaluation pursuant to section 4(4) sentence 2 of the Repository Site Selection Act. Six members, appointed by the Bundesrat and the Bundestag, should be highly esteemed public figures. In addition, two citizens are to be selected at random³⁶ and there should be one representative from the younger generation.
- After completion of the evaluation of the Repository Site Selection Act, the national support body shall consist of 18 members: six citizens selected at random, of which two should represent the younger generation of 16 to 27 year olds, and twelve respected public figures.

The German Bundestag and the Bundesrat will appoint the twelve respected public figures. The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety will appoint the random citizens and representatives of the younger generation, who will have been nominated in a suitable procedure in advance, for example in the context of a planning cell. These members must not be members of a federal or state legislative body nor of the federal or a state government; they must not have any business interests in relation to the site selection or final disposal in the broadest sense. The term of office for members is three years. Reappointment should be possible twice.

The members may inspect all records and documents of the BfE and the BGE. Where these documents are classified pursuant to the Environmental Information Act (UIG), the members may be required to maintain confidentiality.

The national support body will help identify any need for change or innovation during the procedure. If it concludes that parts of the procedure or decisions need to be reassessed, it can recommend the corresponding amendments to the legislator. On the basis of these recommendations, the legislator can decide to modify the procedure or even return it to an earlier stage. The national support body can consult a scientific council it may have appointed

³⁶ Cf. section B 7.4.1.2 of this report for details of this procedure.

or individual experts to aid its deliberations, process structuring or to obtain scientific expert opinions.

The national support body appoints one commissioner for participation. This commissioner will assist in settling disputes or mediating in the event of conflict and is thus responsible for conflict management. The national support body is also the ombudsman institution for the public and contact point for all participants in the site selection procedure and for those affected by the interim storage facilities.

The appointment of citizens sets a clear signal of the special role of the national support body. Numerous examples from past experience in Germany and abroad have shown that the principle of having a citizens' panel where citizens participate in an unprejudiced and qualified way strengthens representative democracy and exerts a mediating influence in the debate with critical stakeholders.

The national support body has the right to advise on its own initiative and the right to file complaints and can thus pose questions to the BfE and the BGE at any time and demand an answer. It shall synchronise its work with the schedule of the regional conferences and with their reviews in order to avoid overlaps and delays.

In each phase, the national support body shall submit the results of its consultations to the federal government and the legislator.

4.2.4 Regional conferences³⁷

The central institutions for the participation of affected parties are the regional conferences. In every region that has been proposed as a site region for surface exploration in phase 1, a regional conference will accompany the steps of the procedure in a long-term and intensive way. The Federal Office for the Safety of Nuclear Waste Management (BfE) will set up the regional conferences and provide them with organisational and financial resources for their entire duration. The regional conferences should be empowered to shape their work themselves and with a high degree of autonomy from the BfE.

A regional conference consists of its plenary session and its group of representatives. The main task of the regional conferences is to closely accompany the entire site selection process and to check the accuracy and comprehensibility of the key proposals and decisions. If the regional conferences identify deficits that cannot be clarified in dialogue with the BfE and the BGE, it is their task and the right to file a request once before each Bundestag decision for such deficits to be reviewed.

It is also the responsibility of the individual conferences to inform the public in their region about the progress of the site selection process and to involve the public on an ongoing basis. Important means for achieving this are rights to participate in the information platform as well as autonomous forms of public participation that each regional conference can decide on and shape itself.

Citizens who are entitled to vote and stand for election in local government elections in a local authority in the region are invited to the plenary session in writing. The plenary session has the following tasks:

- It appoints/confirms the members of the group of representatives.
- It serves as the discussion forum for the members of the group of representatives.
- It can submit requests and proposals to the group of representatives.

³⁷ Cf. section B 7.4.3 of this report.

The group of representatives manages the conference's operations and makes decisions. Important decisions, such as those concerning review requests, are taken after a hearing before the plenary assembly.

The group of representatives is composed to one third of each of the following institutions and groups of persons:

- Local government representatives at the municipal and district level.
- Representatives of civil society groups such as business, environmental and other organisations whose field of action is directly related to the repository site selection issue.
- Individual citizens

The members of the group of representatives are appointed by the plenary session or confirmed in the case of local government representatives. The election procedure applied should produce an outcome of three subgroups of equal size in the group of representatives. For the segment "local government representatives", the BfE will request a list of representatives from the respective county councils and councils of the independent urban municipalities. For the segments "civil society groups" and "individual citizens" the BfE will define a procedure to nominate candidates together with the local government representatives. Both the representatives of "civil society groups" and "individual citizens" are appointed by the plenary session of the regional conference.

The members of the group of representatives are each appointed for a term of three years and may be re-elected twice.

The commission assumes that the regions will need to be defined according to geological aspects and social and economic aspects in equal measure. The regional conferences should represent the perspectives of all persons who consider themselves affected by the construction and operation of a repository at the potential site. The sphere of impact can also extend beyond the region above the rock formation.

Participation should not stop at national borders either. Where foreign persons are affected, the commission recommends concluding a state agreement with the affected neighbouring countries regulating their participation.

As a pragmatic general rule, the commission recommends that local authorities whose district is located above the potential repository site should form one joint region together with all directly adjacent local authorities. This general rule should be adapted to the individual geographical conditions.

A central right of every regional conference is to file a review request if it identifies a deficit in the reports of the BGE or a deficit that it believes does not comply with the procedural requirements laid down in the Repository Site Selection Act, and this deficit cannot be remedied in cooperation with the BfE and the BGE. The review can be requested once before each decision taken by the Bundestag pursuant to the Repository Site Selection Act. The BfE and the regional conferences agree on a reasonable time period. If they fail to reach agreement on this point, it is decided by the national support body.

The capacity to request reviews aims to give the site selection procedure strong powers of influence from the affected persons, to resolve conflicts in good time and to reduce the risk of the procedure being broken off or delayed for the long term.

Reviews requested by the regional conferences should relate to an impending decision in the site selection procedure and specify the identified or alleged defects as clearly and precisely as possible.

The Federal Office for the Safety of Nuclear Waste Management (BfE) processes the review request and involves the BGE where necessary. Review results are presented to the legislator together with statements from the requesting bodies.

4.2.5 Supra-regional participation

Supra-regional participation will form a bridge in the public participation process between the public interest perspective and the participation of affected persons. It will enable:

- Open dialogue between the BfE and implementing agency and the directly, actually affected or potentially regionally affected actors.
- Intensive awareness of the other perspective in each case.
- The opportunity to address existing or potential conflicts on a low level of escalation.
- Sharing of experience, in particular between the regions that are still in the process.

Each phase of the site selection procedure will require different forms and contents of supra-regional participation.

4.2.5.1 Subregions expert conference

When the Repository Commission has completed its work and the search for the future repository site is just beginning, participation of affected regions and its citizens will not be possible, as no potential site regions will yet have been selected. However, it would still be advisable to offer forms of participation already at this point to accompany the process of creating the structures of the participatory selection procedure and the compilation of the BGE's interim report in phase 1 of the site selection procedure.

The objective is to mitigate the paradox of participation. Experience has shown that although there may be extensive options for participation at the beginning of many processes there is usually hardly any interest in making use of such opportunities at this stage. A good option to counter this trend would be to continue the formats³⁸ developed and successfully implemented during the work of the Repository Commission and introduce a subregions expert conference.

The subregions expert conference would make it possible to shorten the purely informational phase and to initiate expert consultations in good time before primarily regional interests take over. The subregions expert conference will debate on the interim report of the BGE following step 2 of phase 1.³⁹ It will examine the application of the exclusion criteria and the geological minimum and geoscientific assessment criteria in phase 1 according to which the BGE will have identified the subregions and submit a report on this.

4.2.5.2 “Council of the regions” expert conference

Once the regional conferences have been set up, we recommend setting up a “council of the regions” expert conference. In this expert conference, representatives of the regional conferences can share the experiences gained on the processes in their respective regions and develop a supra-regional perspective on the search for the best site. Representatives of the interim storage sites should also participate in the expert conference. This will enable potential problems and areas for optimisation to be identified and addressed more efficiently. The regional representatives should jointly address the processes and, further down the line, also the proposed decisions for the identification of the site with the best-possible safety. Efforts should be made in this collaboration to help find ways to counterbalance the antagonistic and conflicting interests of the regions. The “council of the regions” expert conference and the regional conferences conduct their work in parallel in terms of content and time.

³⁸ Cf. section B 7.7 of this report “Participation in the commission’s work”.

³⁹ Cf. section B 6.3.1 of this report.

It is certainly possible that conflicting interests between the individual regions will emerge in the course of the process that cannot be resolved on a regional level. As described in the section “Dealing with conflicts”,⁴⁰ these opposing interests need to be spotted in good time and addressed using a procedure such as the four-step model.

4.2.6 Procedure on opinions and discussion meetings

At the end of each phase, once the proposal in each case has been discussed in the regional bodies and a review and revision has taken place if required, the proposal is presented for consultation to the general public and to the agencies of public interest. This step is a safeguard for public participation with clearly defined legal procedural elements.

Pursuant to Section 9(3) of the Repository Site Selection Act, the public shall be given the opportunity to give its opinion on the contents described in Section 7.2.1. The BfE shall prepare the information to be made available in an appropriate manner and present it on the information platform and in other suitable media in a way that makes it comprehensible to the various target groups.

The BfE submits the opinions made by the general public to the BGE in its capacity as implementing agency. In a first step, the implementing agency undertakes a qualitative and a quantitative evaluation of the opinions to identify the main points being made. In a second step, each opinion is examined and considered individually. The BGE compiles an evaluation report in which it summarises all the conclusions drawn. On the basis of this evaluation, the BfE publishes the conclusions it, in turn, has drawn and plans to take into consideration in the further steps of the procedure. The evaluation and the conclusions form the basis of the subsequent discussion meeting to which the target groups are invited to attend by the BfE.

At the end of a phase, the BfE schedules a discussion meeting. All interested citizens are free to deliver an opinion and participate in the discussion meeting. These meetings should be held in the geographical area of the project. The announcement of the discussion meeting shall be made in good time and via the appropriate channels. In addition, the representatives of the implementing agency, the regional bodies, the affected local authorities and agencies of public interest should attend.

The results will feed into the BfE report on the participation of the public and in the reports of the regional conferences and the national supporting body.

4.3.7 Site agreement

The commission’s recommendations for public participation are based on the theory that two key conditions need to be met in order for the citizens of a region to tolerate the construction and the operation of the repository there. First, a confidence-inspiring controlling process must be carried out to ensure that the selected site and the implementation of the repository comply with the concept of the best-possible safety. The second is that the region must be in a position to compensate effectively and lastingly for the burdens caused by the construction of the final repository and the transport of the containers. A negative branding of the region must be countered with the development of a concept for compensatory measures.

The strategies of how to implement these measures should be developed individually for each region. To develop and validate suitable long-term strategies, a detailed investigation into the economic, historical and social potential of the region will be required. The objective of these strategies must not be merely to achieve compensation in the form of a short-term financial compensation but rather to elaborate the long-term development potential for the region in question and provide a differentiated response to the construction of the repository. The

⁴⁰ Cf. section B 2.4 of this report.

concerns of the current population as well as expert knowledge and predictions of future developments all need to be incorporated into this process.

The partners of such an agreement should be the Federal Republic of Germany on the one hand, and the local authorities of the region where the site is to be located on the other. It will only be possible to conclusively demarcate this region in phase 3.

The object of an agreement could be:

- The key features of the facilities that offer scope for design freedom such as the connection to transport routes, surface facilities, protection against emissions, framework conditions for the emplacement process, waste capacity
- Long-term obligations in the operational and post-operational phase
- Compensations that are effective across generations and boost the development potential of the regions and balance out potential negative side effects of the repository.

Recourse to legal redress remains unaffected by such an agreement.

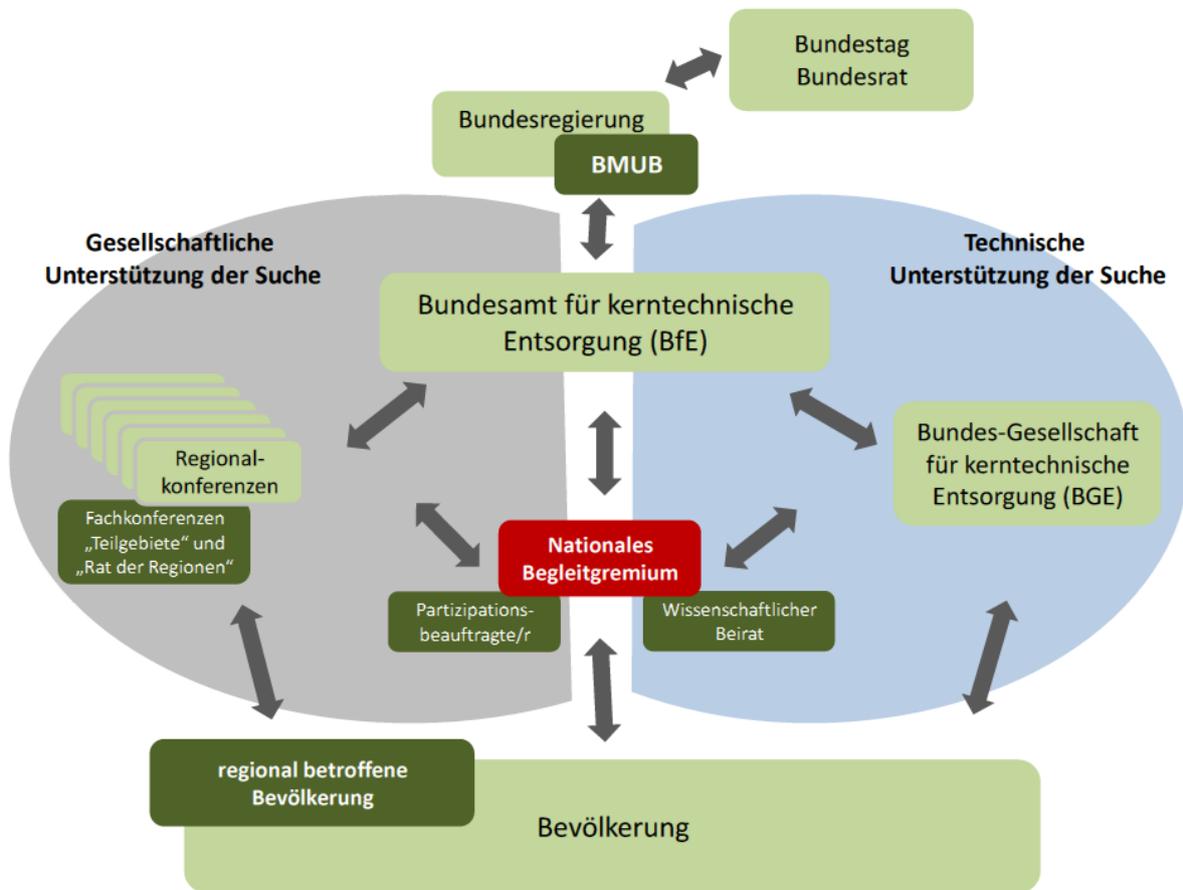
4.2.8 Adaptive system of participation

A necessary precondition for successful participation over such a long time span and in the context of such a complex issue is a robust system of participation. Such a system must be based on a clear definition of roles of the actors involved and their respective options for participation.

This kind of system must be able to respond flexibly to changes and to conflicts that are bound to arise in the course of the site selection procedure. Errors and defects may also become apparent during this procedure, in fact, they are even to be expected. The collaboration of the BfE, the BGE, the national supporting body and the regional conferences, supported by scientific evaluation and a commissioner for participation with a remit to deescalate conflict, is designed to ensure that participation – and thus the whole procedure – does not come to a standstill on account of unexpected events at a certain point.

The way that conflicts, mistakes, the unexpected and the unknown are dealt with is enormously important here. The aim of this adaptive system of participation that is empowered to be self-healing is not to avoid all conflicts from the outset but rather to integrate these and view them as a driver of participation. The system of participation is thus not a corset whose every detail has been decided on in advance but rather a robust, living, adaptive organism, where every actor can contribute to a successful outcome:

Figure 1: Citizen participation in the site selection procedure



4.3 Decision-making criteria and their function in the site selection procedure

The site selection procedure for identifying the site for a repository of high-level radioactive waste in particular with the best-possible safety will be conducted in several stages and guided by specific criteria. The commission proposes the application of the following types of criteria:

- Geoscientific exclusion criteria
- Geoscientific minimum specifications
- Geoscientific assessment criteria
- Safety requirements and requirements for safety analyses
- Planning science criteria

The exclusion criteria, minimum specifications and assessment criteria as well as the safety requirements and the requirements for the safety analyses remain valid throughout all three phases of the site selection procedure. The safety requirements that evolve further during the course of the procedure should be made available in a version that corresponds to the current state of knowledge, science and technology. From phase 1 to phase 3 of the site selection procedure the criteria will be applied in ever increasing detail and with ever more accurate data. In a step-by-step process, starting with a white map of Germany, the site with the best-possible safety will thus be identified.

4.3.1 Geoscientific exclusion criteria and minimum specifications

These two types of criteria are applied for the first time at the beginning of the site selection process in step 1 of phase 1. Through application of the geoscientific exclusion criteria, all

regions are permanently excluded from the further procedure that are not suitable for a repository from the outset based on the factors defined in the criteria. In the same way, the geoscientific minimum criteria are applied to permanently exclude all regions from the further procedure that do not meet these minimum specifications.

Table 2: Geoscientific exclusion criteria

An exclusion criterion is a criterion whose fulfilment means that the site region or site in question is not suitable for a repository and is thus excluded from the further procedure.

Exclusion criterion	Exclusion characteristic
Broad vertical movements ⁴¹	Broad geogenic uplift of more than 1mm per year on average in the period under review.
Active fault zones ⁴²	Fault lines on which movements have demonstrably or highly probably taken place in the period between the Rupelian age and the present. Atectonic or aseismic processes that could have a similar impact on safety as tectonic disruptions are to be treated like the latter.
Influences from ongoing or former mining activities ⁴³	Ongoing or former mining activities with impairments that give reason to believe they could negatively impact the stress state and the permeability of the rock foundation in the region of the repository and, particularly, of the effective containment zone (ECZ).
Seismic activity ⁴⁴	Seismic activities greater than earthquake zone 1 as per DIN EN 1998-1 / NA 2011-01.
Volcanic activity ⁴⁵	Quaternary volcanic activity or volcanic activity expected in the future.
Groundwater residence time ⁴⁶	Concentrations of tritium and carbon-14 (radiocarbon) in the ECZ above the natural background level indicate less residence time.

In the subsequent phases of the site selection procedure, additional data will be gained from the site regions that have been examined in greater detail: in phase 2 through surface exploration

⁴¹ Cf. section B 6.5.4.1 of this report.

⁴² Cf. section B 6.5.4.2 of this report.

⁴³ Cf. section B 6.5.4.3 of this report.

⁴⁴ Cf. section B 6.5. 4.4 of this report.

⁴⁵ Cf. section B 6.5. 4.5 of this report.

⁴⁶ Cf. section B 6.5. 4.6 of this report.

and in phase 3 through underground exploration. If the additional data reveal that a potential site that is still included in the procedure fulfils a geoscientific exclusion criterion after all or does not meet one of the geoscientific minimum specifications then the site in question is definitively excluded from the procedure at this point.

The geoscientific exclusion criteria and the minimum specifications are elaborated in Part B of this report in sections B 6.5.4 and B 6.5.5. According to the Repository Site Selection Act they are to be defined by law prior to the start of the site selection procedure, as they need to be defined prior to their first application in order to maintain the transparency of the procedure and to comply with the principle of procedural clarity.

Table 3: Geoscientific minimum specifications

Minimum requirement	Characteristic
Permeability of rock foundation ⁴⁷	Within the effective containment zone (ECZ), the permeability k_f of the rock foundation must be less than 10 ⁻¹⁰ m/s. Overlying layers can also assume the function of the effective containment zone.
Thickness of effective containment zone ⁴⁸	The effective containment zone must be at least 100 m thick. For formations of less thickness where the host rock is crystalline and rock permeability is low, proof of long-time containment for the effective rock formation can be furnished through the combined safety of the host rock with geo-technical and technical barriers. Subdividing a repository system into several such containment areas is permissible.
Depth of the effective containment zone ⁴⁹	The surface of the ECZ must be located a minimum of 300 m below the ground surface. It must be deeper than the expected greatest depth of the impact of exogenous processes. It must be located at a depth at which, in the case of rock salt, a salt suspension of at least 300 m over the ECZ is given. In the case of clay stone it must be located at a sufficient depth to be able to rule out a degradation of the integrity of the ECZ through decompaction, also with consideration of the exogenous processes.

⁴⁷ Cf. section B 6.5.5.1 of this report.

⁴⁸ Cf. section B 6.5.5.2 of this report.

⁴⁹ Cf. section B 6.5.5.3 of this report.

Area of repository ⁵⁰	The area of the ECZ must be sufficiently large to allow for the construction of the repository.
Findings on the effective containment zone for the period under review ⁵¹	There must not be any findings or data that cast doubt on the integrity of the ECZ over a period of one million years.

A minimum requirement for the selection of a repository site region or a repository site is a requirement that must be met in all cases. If a requirement is not met then the site is not suitable and is excluded from the further procedure.

4.3.2 Geoscientific assessment criteria

The purpose of the assessment criteria is to allow comparison between the site regions or the sites that remain in the procedure following the application of the exclusion criteria and the minimum specifications. The preliminary safety analyses in combination with the geoscientific assessment criteria are then used to evaluate the geological conditions as more or less suitable. The application of these criteria does not lead to the exclusion of any regions but instead to rank them according to their relative suitability. The criteria are used to decide whether a subregion or a site region has a favourable overall geological situation or not. The general rule with these criteria is that an individual assessment criterion is not sufficient either to verify or to rule out a favourable overall geological situation. The overall geological situation is therefore not deemed to be favourable if one particular criterion is met to an exceptionally great extent, but in accordance with the fulfilment or degree of fulfilment of the sum of all the requirements of the assessment criteria. Geoscientific assessment criteria are the key element of a comparative selection procedure that ultimately aims to identify the site with the best-possible safety within a group of possible sites. In the interests of transparency and in keeping with the principle of procedural clarity these criteria are to be defined by law before the beginning of the site selection procedure.

The geoscientific assessment criteria are applied for the first time in step 2 of phase 1 of the site selection procedure and are then used throughout the entire rest of the selection procedure. In step 2 of phase 1 they serve to identify subregions with favourable basic geological conditions. In step 3 of phase 1 they are designed, within the context of a more in-depth assessment together with representative preliminary safety analyses and the application of planning science criteria, to select site regions for surface exploration.

They are also applied in phase 2 and phase 3 in combination with the findings from the respective safety analyses to elaborate and substantiate the proposal of sites for underground exploration and for a site proposal according to safety aspects. An argument-based assessment process is required to evaluate and compare the site regions or sites under consideration in each case. In each step of the process, all the requirements and the corresponding assessment criteria must be evaluated and checked for the site regions and sites in question in accordance with the current state of knowledge. The commission does not believe that official rules on aggregation,

⁵⁰ Cf. section B 6.5.5.5 of this report.

⁵¹ Cf. section B 6.5.5.6 of this report.

particularly ones involving the compensatory aggregation of individual results of the application of criteria, are expedient. All steps in the argumentation must be transparent and are subject to the review rights⁵² in the context of public participation.

The geoscientific assessment criteria are divided into three groups of criteria. These are elaborated and explained in the second part of this report.⁵³

Criteria group 1 – quality of the containment capacity and reliability of the evidence – includes those assessment criteria used to compare the site regions or sites according to the quality of the containment of radioactive substances in the repository site and the reliability of the evidence furnished as proof of long-term safety. Both of these factors are central aspects of final disposal. They indicate that a long-term containment of radioactive substances is possible at the potential repository site and that this has been shown in the context of a verification procedure with sufficient certainty and can be predicted for the duration of the period under review.

The containment capacity at the site of disposal, either through the identification and verification of one or possibly several effective containment zones or through the combined impact of technical, geotechnical and geological barriers in a long-term stable environment, is the central geological property of the entire repository system and is thus the primary site characteristic that the site selection procedure is seeking to find.

Table 4: Geoscientific assessment criteria, criteria group 1
Quality of containment capacity and reliability of the evidence

Requirement	Criteria
No or slow transport through groundwater in the effective containment zone (ECZ) ⁵⁴	Groundwater flow (interstitial velocity) in the ECZ as low as possible, i.e. less than one millimetre per year
	Available groundwater resources as low as possible in the ECZ
	Diffusion rate as low as possible in the ECZ
Favourable configuration of rock formation, particularly of host rock and ECZ ⁵⁵	Barrier effectiveness (thickness and degree of enclosure of the repository site or the host rock formation by the ECZ).
	Robustness and safety reserves exceeding the minimum specifications
	Area of the ECZ in relation to the minimum requirement

⁵² Cf. section A 4.2 of this report.

⁵³ Cf. section B 6.5.6 of this report.

⁵⁴ Cf. section B 6.5.6.1.1 of this report.

⁵⁵ Cf. section B 6.5.6.1.2 of this report.

	For clay stone: connection of water-carrying layers in the immediate proximity to the ECZ or the host rock formation to a high hydraulic potential
Good spatial characterisability ⁵⁶	Determinability: low range of variation and equal distribution of the characteristic properties of the ECZ, lowest possible tectonic overprint
	Transferability: largely uniform or very similar formation of the rock within the ECZ
Good predictability of long-term stability of the favourable conditions ⁵⁷	Change in <ul style="list-style-type: none"> - the thickness of the ECZ - the area of the ECZ - the permeability of the rock formation of the ECZ over time

Criteria group 2 – safeguarding the containment capacity – contains assessment criteria that evaluate how well the rock formation can maintain its containment capacity under stresses that will occur in the construction and operation of the underground cavities of the repository.

Favourable properties are a high bearing capacity of the rock formation, which would provide high stability for the cavities that need to be opened up, the lowest possible propensity towards decompaction, the lowest possible propensity towards forming new or reactivating fossil water pathways in the effective containment zone, and the ability to respond to crack formation with self-healing processes.

Table 5: Geoscientific assessment criteria, criteria group 2

Safeguarding containment capacity

Requirement	Criteria
Favourable mechanical conditions of the rock ⁵⁸	Low propensity to form mechanically-induced secondary permeabilities in the host rock and in the ECZ outside of a near-contour excavation-damage zone around the repository cavities.
	Changeability of rock permeability

⁵⁶ Cf. section B 6.5.6.1.3 of this report.

⁵⁷ Cf. section B 6.5.6.1.4 of this report.

⁵⁸ Cf. section B 6.5.6.2.1 of this report.

Low propensity to form water pathways in the host rock formation and in the ECZ ⁵⁹	Elimination of cracks or secondary permeabilities through crack closure or healing of cracks
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Criteria group 3 contains assessment criteria for evaluating the robustness of the repository system. They consider the fact that the function of the repository is not over at the end of the period under review, but that the containment should be maintained for an unlimited period of time, at least from a human perspective, and that properties supporting this unlimited containment are to be rated as positive in the assessment of otherwise equal sites.

Favourable properties in this criteria group strengthen and increase the safety of the system as a whole beyond the containment capacity evaluated in the criteria groups 2 and 3. They consider, for example, whether the area near the waste provides a favourable environment to minimise corrosion and gas formation, or if the heat from the waste is transported rapidly and without mineral transformation into the rock and counters the build-up of critical gas pressure. The radionuclide retention capacity of the rock in the effective containment zone restricts or prevents the transportation of radionuclides into the biosphere in the event of radionuclide release from the waste.

An overburden that additionally protects the effective containment zone against unfavourable influences, such as erosion, subsidence or glacial channels and/or has the ability to retain radionuclides, also increases the robustness of the repository system.

Table 6: Geoscientific assessment criteria, criteria group 3

Requirement	Further properties relevant to safety Criteria
Protective structure of overburden ⁶⁰	Protection of ECZ through: Overburden of ECZ with groundwater-retarding rock formations Spread and thickness of the groundwater-retarding rock in overburden Spread and thickness of erosion-retarding rock in overburden No structural complications in overburden
Good conditions to prevent or minimise gas formation ⁶¹	Lowest possible gas formation of waste under disposal conditions

⁵⁹ Cf. section B 6.5.6.2.2 of this report.

⁶⁰ Cf. section B 6.5.6.3.5 of this report.

⁶¹ Cf. section B 6.5.6.3.1 of this report.

Good temperature tolerance ⁶²	As a precautionary measure, the commission recommends setting a maximum temperature of 100 degrees Celsius for the external surfaces of the containers as long as the physically maximum temperatures tolerated by the respective host rock have not been reliably determined through research.
High retention capacity of the ECZ of radionuclides ⁶³	Greatest possible sorption capacity of the rock mass in the ECZ Highest possible contents of mineral phases with large reactive surface in the rock mass of the ECZ Highest possible ionic strength of the groundwater in the ECZ Opening widths of the rock pores in the ECZ in nanometre range
Favourable hydrochemical conditions ⁶⁴	The deep groundwater in the host rock / in the ECZ should <ul style="list-style-type: none">- be in chemical equilibrium with the rock- have a pH value of 7-8- exhibit favourable redox conditions (anoxic-reducing environment)- exhibit lowest possible content of colloids and complexing agents- exhibit lowest possible carbonate concentration

4.3.3 Requirements for safety analyses

In the Repository Site Selection Act, the methodology for the required preliminary safety analyses serves as an important decision-making basis for narrowing down the potential site regions and the site selection. According to the explanatory memorandum of the law, a safety investigation analyses the properties of the repository system under a range of different stress situations and takes account of data uncertainties, malfunctions and future potential developments with regard to fulfilment of the safety functions. It also includes an evaluation of the reliability with which the safety functions will be fulfilled and thus also the robustness of the system.

The preliminary safety analyses must include an assessment of the geological properties of the site regions or the site that could have either a particularly positive or a particularly negative impact on the repository system.

To ensure the credibility of the findings of the preliminary safety analyses and the comparisons between the different sites and host rock formations, the methodology of the preliminary safety analyses to be conducted and the data and information required for this purpose must be defined before the start of the comparative analysis.

The degree of detail of the preliminary safety analyses and validity of their findings will increase in line with the increasing information obtained through the exploration of the site regions and the sites in each subsequent phase of the procedure. The safety concept and the final disposal concept need to be reviewed and further developed in line with the increasingly solid basis of knowledge. In the final phase of the site selection procedure, the implementing agency conducts a comparative analysis of the remaining sites on the basis of the test criteria for evaluating the findings of the underground exploration and on the basis of the findings of

⁶² Cf. section B 6.5.6.3.2 of this report.

⁶³ Cf. section B 6.5.6.3.3 of this report.

⁶⁴ Cf. section B 6.5.6.3.4 of this report.

the extensive preliminary safety analyses for the operational and post-closure phase, and subsequently submits a proposal for a site.

The conclusive proof of safety or “safety case”,⁶⁵ for the site that is ultimately selected is based on an extensive safety analysis that requires extensive data and knowledge about the repository system, the effective containment zone, and the geological environment.

4.3.4 Test criteria

It will only be possible to define test criteria in the course of the procedure. The findings of the preceding investigations are needed for these to be defined. To meet the requirement of transparency of the procedure and the principle of procedural clarity, these criteria must be defined before in good time before in-depth underground exploration is undertaken and have been reviewed in accordance with the provided review rights.

For this reason, the commission does not propose the test criteria themselves in section B 6.5.7 but rather the procedure and the point in time at which these test criteria should be defined.

4.3.5 Planning science criteria

As safety takes primacy, the commission believes that the planning science criteria should always be assessment criteria, rather than exclusion criteria. Pursuant to Section 1(1) of the Repository Site Selection Act the objective of the site selection procedure is to “find the site for final disposal ... that delivers the best-possible safety for a period of one million years.” The commission has confirmed this objective and has specified that long-term safety takes precedence over other considerations that could also be included in narrowing down the list of potential sites.

In the selection procedure, the planning science assessment criteria are therefore always only applied after the geoscientific criteria, i.e. once the safety evaluations of the regions under consideration are available. The planning science criteria are applied for the first time in step 3 of phase 1 to further narrow down the selection of subregions that are potentially suitable according to safety aspects. The same approach should be taken in phase 2 and phase 3 of the selection procedure.

The planning science assessment criteria are divided into three groups of weightings. These are elaborated in Part B section 6.5.9 and must be defined by law before the start of the site selection procedure to ensure the transparency of the procedure and procedural clarity. The commission divides these into surface and underground science planning criteria.

Table 7: Science planning assessment criteria

Weighting group	Criteria
Weighting group 1 Protection of mankind and human health ⁶⁶	Distance from existing built-up areas in the form of residential and mixed-use zones
	Emissions (noise, radiological and conventional pollutants)
	Near surface groundwater reserves for the abstraction of drinking water
	Flood plains

⁶⁵ “Safety case” is the documented proof that a facility or a product has the required safety characteristics.

⁶⁶ Cf. section B 6.5.9.7 of this report.

Weighting group 2 Protecting unique natural and cultural heritage sites from irreversible damage ⁶⁷	Nature reserves and Natura 2000 sites
	Important cultural heritage sites (such as UNESCO World Heritage Sites)
	Deep groundwater reserves for the abstraction of drinking water
Weighting group 3 Other competing uses and infrastructures ⁶⁸	Facilities that are subject to the German Hazardous Incident Ordinance
	Mining of natural resources, including fracking
	Use of subsurface geothermal energy
	Use of geological formations as underground storage (compressed air, carbon-dioxide compression, gas)

5 POLITICAL AND SOCIAL RECOMMENDATIONS

For the political implementation of its proposals for a fair and transparent site selection procedure, the commission has elaborated a series of concrete and partly detailed proposals to amend the Repository Site Selection Act and other legal regulations. Its recommendations include restructuring and simplifying the public authorities and the public and semi-public enterprises involved in the site selection. Its recommendations also relate to final disposal research and the collection and storage of data and knowledge required for final disposal. The commission has further elaborated general conclusions for the technological assessment arising from the problematic legacy of nuclear power.

5.1 New organisational structure

The commission reached the conclusion that the organisational structure set down in the Repository Site Selection Act requires amendment. The structure of public authorities set down in the Act is, in particular, not suitable for properly and swiftly accomplishing the multifaceted tasks surrounding final disposal, including the required restructuring of public participation.

The commission has proposed concentrating all approval, monitoring and supervisory tasks relating to the safety of the disposal of spent fuel elements and radioactive waste in a single higher federal authority, where these are not assumed by the federal states. The commission recommends, in particular, taking operational responsibility out of the hands of the Federal Office for Radiation Protection (BfS) and bundling these tasks and the tasks of the operational management companies of the Deutsche Gesellschaft zum Bau und Betrieb von Endlagern für Abfallstoffe (German company for the construction and operation of repositories for waste material) and the federal government-owned Asse GmbH in a new federal government-owned company. This company will need to be newly founded and in its capacity as the future implementing agency will be tasked with site selection, construction, operation and

⁶⁷ Cf. section B 6.5.9.8 of this report.

⁶⁸ Cf. section B 6.5.9.9 of this report.

decommissioning of the repository. In the opinion of the commission, this company should be wholly state-owned, be given entrepreneurial freedom of action, and not be directly tied to federal budgeting.

These proposals have already been accepted by the Bundestag; at the time of writing of this report, they were in the process of being enacted.

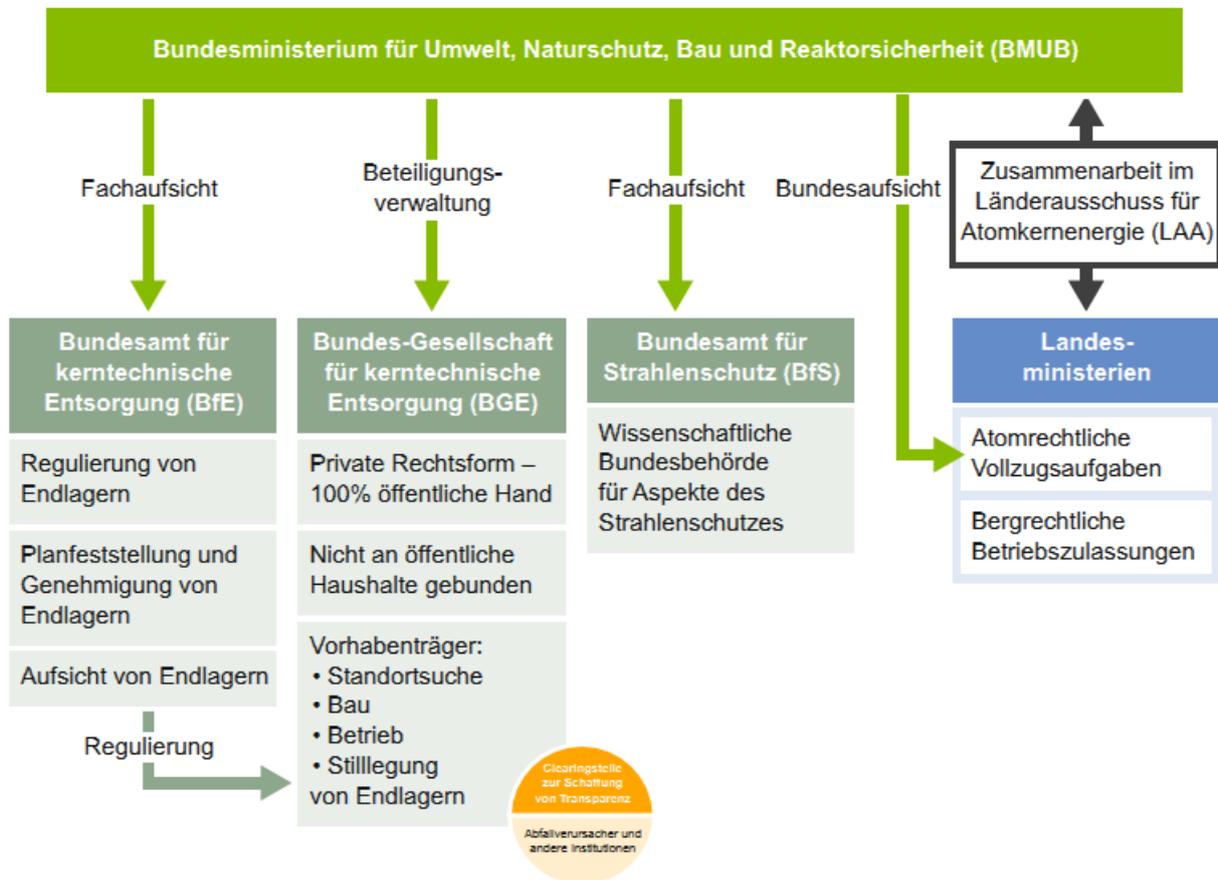
Recommendation:

- The operational tasks of the BfS, DBE and Asse GmbH should all be bundled in the BGE (Bundes-Gesellschaft für kerntechnische Entsorgung). This new company is 100-percent state-owned.
- This new state-owned company should, to the extent possible, be set up in agreement with the current owners of DBE, in particular. Privatisation of this company in the future is excluded.
- In the interest of transparency, the waste producers and, where relevant, other institutions should be involved in advance in decisions taken by the federal government-owned company. This could be made feasible in a suitable way by a clearing office,⁶⁹ for example.
- All the tasks and resources of BfS in its capacity as operator, of DBE and Asse GmbH in their capacity as providing administrative support in the planning, construction, operation and decommissioning of repositories, and the BfS as implementing agency pursuant to the Repository Site Selection Act should be transferred to the new company without delay.
- The BGE should be operated as an enterprise under private law. Its central task is the site selection and the construction, operation and decommissioning of repositories for radioactive waste. It is not directly tied to public budgeting.
- All regulating, approval, and supervisory tasks concerning the safety of the disposal of spent fuel elements and radioactive waste should be concentrated in a single higher federal authority, where these tasks are not assumed by the federal states. Adequate personnel and financial resources are to be provided. This does not mean that the way responsibilities are divided between the Federation and the states as per the Repository Site Selection Act and the German Atomic Energy Act requires amendment.
- Independence as per the requirements of the Council Directive 2011/70/EURATOM is to be ensured.

The following figure presents the organisational structure proposed for implementation in the commission's recommendations:

⁶⁹ This recommendation does not yet include the recommendations of the commission reviewing the financing of Germany's nuclear phase-out (KFK), which also propose changes regarding responsibility for the disposal of radioactive waste..

Figure 2: Recommended new organisational structure



Organisationsrahmen Behörden der Bundesrepublik Deutschland im Bereich der Entsorgung bestrahlter Brennelemente und radioaktiver Abfälle nach Umsetzung der Empfehlungen der Endlager-Kommission vom 2. März 2015

These proposals, with the exception of the clearing office, have already been accepted by the Bundestag; they were in the process of being enacted at the time of writing.

5.2 Recommendations to the legislator

5.2.1 Legal protection

The issue of adequate legal protection in the site selection procedure pursuant to the Repository Site Selection Act (StandAG) and in the subsequent approval procedure pursuant to the Atomic Energy Act (AtG) was addressed separately under the headings “compatibility of existing legal regulations with the requirements of Community law” and “options of legal redress under national law”.

Implementation of requirements under Community law: The commission established that the legal protection currently granted in the Repository Site Selection Act does not satisfy the legislative requirements of Community law pursuant to the EIA Directive and Article 9(2) of the Aarhus Convention. The provisions for legal protection of the EIA Directive enacted in the implementation of Article 9(2) of the Aarhus Convention stipulate that in the case of project approvals that require an environmental impact assessment, non-governmental organisations have the right to request a review of the substantive and procedural legality of the final decision

on an approval procedure. With this in mind, the commission proposes extensive amendments to Sections 19 and 20 of the Repository Site Selection Act through implementation of a new right to legal protection based on Section 17(4) of the Repository Site Selection Act. This would meet the requirements of Community legislation.

Options for legal protection under national law: The commission debated at length on whether the legal protection option provided for so far in Section 17(4) of the Repository Site Selection Act should be upheld in addition to the scope for legal protection proposed by the commission for Section 19(2) or, rather, should be replaced by the same. Good reasons were given for both sides of the argument. In the course of the debate, one of the arguments presented was that where the site selection and approval procedure are concerned, citizens have numerous further rights of appeal for example against mine planning approvals, permissions for exploration issued under water law, and orders to consent to exploratory work on property.⁷⁰

The issue of legal protection in the framework of Section 14 of the Site Selection Act was also addressed.

In consideration of all the arguments and the legal pros and cons, the commission regards this issue as one that ultimately needs to be decided on the basis of political criteria. With this in mind, the commission therefore recommends retaining the legal protection granted so far in Section 17(4) of the Site Selection Act without amendment.

In the expert hearing of the commission held on 3 November 2014,⁷¹ opinion already diverged among the experts present concerning the need to provide options for legal protection under the Repository Site Selection Act that go beyond the scope prescribed by Community legislation: Some believed that instead of providing for further options of legal protection, the focus should be put on negotiation, mediation and consensus.⁷² Others were of the opinion that further legal protection was required to attain the objective of extensive public participation and the concomitant increase in acceptance of the procedure.⁷³ The legal protection granted so far in Section 17(4) of the Site Selection Act would basically no longer be required under Community legislation if the recommendations presented for Section 19 of the Repository Site Selection Act were implemented. Retaining this legal protection would, however, enable legal review to take place at an early stage and thus minimise the risk of the legal protection granted in Section 19 of the Site Selection Act setting the procedure back to a very early stage.⁷⁴ At the same time, an additional option for legal protection could increase confidence in the procedure and thus its acceptance.⁷⁵

In its recommendation, the commission is aware that both cases could lead to delays and have an impact on how the formats for public participation are used. Following intensive discussion, it decided, in the interests of the cross-cutting reasons presented above, to recommend retaining the legal protection of Section 17 of the Site Selection Act.

5.2.2 Gorleben development freeze – securing potential sites

A central point of discussion for the commission was how to deal with the Gorleben site in the pursuit of a national, open-ended site selection procedure pursuant to the Repository Site Selection Act. The main question here for the commission was how to secure all potential sites

⁷⁰ A detailed overview of possible legal remedies is provided in Commission printed paper AG2-27.

⁷¹ Cf. Repository Commission. Analysis of the hearing “Evaluation of the Repository Site Selection Act” / Summary of opinions and results. Commission printed paper / AG2-4a, p.24 ff.

⁷² Cf. Repository Commission. Analysis of the hearing “Evaluation of the Repository Site Selection Act” / Summary of opinions and results. Commission printed paper / AG2-4a, p.15.

⁷³ Cf. Repository Commission. Analysis of the hearing “Evaluation of the Repository Site Selection Act” / Summary of opinions and results. Commission printed paper / AG2-4a, pp. 5 and 7.

⁷⁴ Cf. 12th meeting of the work group “Evaluation” on 2 November 2015, verbatim record (draft), p.33, 36 and 39.

⁷⁵ Cf. 8th meeting of the work group “Evaluation” on 22 June 2015, verbatim record, p.13; Cf. 9. meeting of the work group “Evaluation” on 7 September 2015, verbatim record, p.40.

as early as possible given the trade-off between the required legal certainty, on the one hand, and the principle of equal treatment regarding the premises of the “white map” in the site selection on the other. There was broad agreement that legal alternatives to the one-sided development freeze on Gorleben should be elaborated and put into effect as quickly as possible.

In spring 2015, the main objective concerning the Gorleben were to reach a basic decision on whether to extend the development freeze or not, and if not, how to secure the site in a different way that affords legal certainty. At the time, the Bundesrat and the federal government agreed, partly on the suggestion of the commission, to limit the extension of the development freeze on Gorleben to the end of March 2017 only. Efforts should then be made to establish a general regulation that applies to all potential site regions and sites.

Recommendation: The commission urges the federal government to draft a legal regulation without delay that enables the site regions and planning areas for potential repository sites to be secured at an early stage.

5.2.3 Export ban

Section 1(1) sentence 2 of the Repository Site Selection Act in conjunction with the obligation to deliver set out in Section 76 of the Radiation Protection Ordinance imposes a legal obligation to dispose of irradiated fuel elements from nuclear plants that are operated as nuclear power reactors (i.e. to produce energy) exclusively in Germany. The principle of domestic disposal does not extend to irradiated fuel elements from research reactors.

The export of irradiated nuclear fuel elements was discussed by the commission initially because of an impending relocation of irradiated fuel elements from the experimental reactor group AVR in Jülich. The interim storage facility located there needs to be vacated as its continued operation has not been approved due to safety reasons. As the fuel elements were originally procured from the US, an alternative consideration to the new construction of an interim storage facility at the Jülich site or interim storage in Ahaus was to return the fuel elements to the US. The commission has decided to recommend legally extending the export ban to include irradiated nuclear fuel elements of experimental reactors.

The commission believes that this extension would serve as an important signal emphasising the objective of finally disposing of all irradiated fuel elements within Germany. The commission does, however, believe that it is essential to structure this extension in such a way that it does not restrict science and cutting-edge research in Germany and also takes account of the obligatory aspects of non-proliferation.

Recommendation: The commission recommends the introduction into law of a general ban on the export of high-level radioactive waste.

The commission calls on the federal government to draft a new regulation for a ban on the export of irradiated fuel elements from experimental reactors that takes account of the obligatory aspects of non-proliferation and that enables cutting-edge research, particularly in the experimental reactor FRM II, to continue.

5.2.4 Legal regulation of public participation

The proposed participatory search procedure requires the Repository Site Selection Act to be amended and adapted particularly in relation to public participation. Here, the commission recommends the following amendments and additions in particular:

- In Chapter 2 (Participation of public authorities and the public), the participation system is to be implemented that is described in section 7.3 of this report and includes the following elements of participation:

- Appointment of a national support body and a commissioner for participation, with the option of a scientific council
- Subregions expert conference and subsequent “council of regions” expert conference
- Regional conferences with review rights
- In addition, the further developments of the transparency requirement as described in the proposals on the information platform and the information offices (7.3.4) and on transparency and information rights (7.3.5) need to be incorporated into the Act.
- In Section 10(4) the assessment of acceptance based on the minutes taken, as currently provided for, should be abandoned.
- In Chapter 3 (Site Selection Procedure) the procedure steps currently regulated in Sections 15 and 18 of the Repository Site Selection Act should be integrated into the preliminary procedure proposals (reports) in Sections 14 and 17. In addition, Section 13 needs to be supplemented to the effect that the identification of subregions should be published in the form of the interim report by the BGE.
- The procedure for the participation of the public and the procedure to set time periods, such as described in section 7.5 of this report, should be set out in greater detail in Chapter 2 and Chapter 3.

5.2.5 Public authorities’ access to information in the site selection procedure

In view of the special public interest in long-term safe final disposal, the relevant public authorities need to be given extensive access to information in the search for the repository site. The special public interest in long-term safe final disposal should therefore, already under current law, regularly prevail over private interests in confidentiality and thus enable the required data to be surrendered even if the owner of the data has not consented to this. In view of occasionally rather unclear administrative practice, however, we nonetheless recommend introducing a clarifying legal regulation.

In order to fulfil their tasks, the public authorities tasked with site selection also need to be granted access to geological data collected by private parties. With the planned amendment of the Mineral Deposits Act (LagerstG), the Federal Ministry for Economic Affairs and Energy has identified a good path for implementing this recommendation which is supported by the commission. Alternatively, rather like in the Geodata Access Act (GeoZG), access rights especially for the purposes of the search for a repository site could also be regulated directly within the Site Selection Act.

5.2.6 The right of future generations to long-term safety

Section 17(4) sentence 3 of the Repository Site Selection Act explicitly regulates that municipalities whose municipal territory is located in a site proposed for underground exploration, and the inhabitants of these municipalities, have the same standing to sue as recognised environmental organisations. The notice of the BfE required pursuant to Section 17(4) sentence 1 of the Repository Site Selection Act can thus be contested by these municipalities and their inhabitants without having to show that their own rights have been infringed.

Substantively, recognised environmental organisations have the right to extensive judicial review pursuant to the Environmental Appeals Act (UmwRG). This also includes an inspection of the aspects of long-term safety to be assessed within the framework of safety analyses in

accordance with the current stage of the procedure, that are evaluated in the selection procedure as an element of taking precautions against damage. Pursuant to Section 17(4) Sentence 3 of the Repository Site Selection Act, this right is also extended to municipalities in whose territory a site has been proposed for underground exploration and to the inhabitants of these municipalities.

Recommendation: Against this background, the commission believes there is currently no need to amend the Repository Site Selection Act; the scope for legal protection proposed for inclusion in Section 19(2) of the Repository Site Selection Act should be shaped along the lines of the currently valid Section 17(4) sentence 3 of the Repository Site Selection Act. In addition, a regulation on the repository approval process, based on Section 17(4) sentence 3 of the Repository Site Selection Act, can be included in the Atomic Energy Act.

5.2.7 Environmental tests in the selection procedure

The site selection procedure pursuant to the Repository Site Selection Act requires two strategic environmental tests and one environmental impact assessment to be conducted. One strategic environmental test is to be conducted before the decision on surface exploration pursuant to Section 14(2) of the Repository Site Selection Act and one before the decision on underground exploration pursuant to Section 17(2) of the Repository Site Selection Act. The environmental impact assessment must be conducted prior to the site decision pursuant to Section 20(2) of the Site Selection Act.

According to the expert opinions requested by the commission, these provisions meet the requirements stipulated by Community law.

However, the formulation of Section 11(3) of the Repository Site Selection Act could lead to a lack of clarity on the application of the stipulations of the Environmental Impacts Assessment Act (UVPG) to cross-border participative processes. The references made in Section 11(3) of the Repository Site Selection Act to the Environmental Impacts Assessment Act are of a purely declaratory nature. Even without this explicit reference, their application would already ensue pursuant to Sections 4 and 14e of the Environmental Impacts Assessment Act.

Recommendation: The commission recommends deleting Section 11(3) of the Site Selection Act without substitution.

5.2.8 Site selection and regional planning

Issues of land-use compatibility are to be conclusively reviewed in the site selection procedure in cooperation with the federal states and the municipalities. In any event, no independent regional planning assessment is to be conducted alongside the procedure pursuant to the Repository Site Selection Act. In this procedure, the selection of the repository site is primarily geared to the criterion of safety.

The Repository Site Selection Act is designed to ensure that the Federation is not obstructed or restricted by legal provisions of regional planning or urban land-use planning in its primarily safety-oriented selection of a repository site.

Recommendation: The commission proposes introducing a regulation in the Repository Site Selection Act based on Section 28 sentence 1 of the Grid Expansion Acceleration Act (NABEG). This regulation should be formulated in such a manner that along with regional planning it also regulates other provisions of planning law, such as urban land-use planning in particular.

5.2.9 Comparative procedure for site selection

Different interpretations of the term “site with the best-possible safety” as introduced in Section 1 of the Site Selection Act as the definition of its objective but not then defined in more detail could, in the opinion of some members of the commission, have an impact on the development of comparative criteria and on the design and implementation of the search procedure.

Regarding the aspect also addressed in this context of the allocation of the costs of a comparative search procedure, the commission unanimously decided after extensive discussion that this aspect is not relevant to the question of a comparative search procedure. In the course of the discussion, the Federal Environment Ministry, the federal state ministries and members of the Bundestag repeatedly made clear that in the legislative process the unanimous opinion was that a site selection procedure with the goal of finding the “site with the best-possible safety” would necessarily have to be a comparative procedure. The Repository Site Selection Act therefore has the objective of applying a comparative procedure to identify the best site for a repository for final disposal pursuant to Section 9a(3) sentence 1 of the Atomic Energy Act that ensures the best-possible safety for a period of one million years.

Some commission members still believe that the term is not sufficiently defined in the Repository Site Selection Act; furthermore, from this point of view, Section 17 of the Repository Site Selection Act and, in particular, Section 19 of the Repository Site Selection Act are not formulated explicitly enough to clearly express the intention of the legislator.

With this in mind and following intensive consultation, the commission decided on a definition⁷⁶ for uniform use throughout this report.

While some members believed that the term “site with the best-possible safety” required further legal specification and thus an amendment of the Repository Site Selection Act, other members believed that the Repository Site Selection Act currently in force clearly specifies a comparative site selection procedure and therefore considered an amendment of the law superfluous.

Recommendation: For the purpose of clearer specification, the commission proposes amending Sections 1 and 19 of the Repository Site Selection Act as formulated in section B 8.7.5 of this report.

5.2.10 Storing data for documentation purposes

The Commission on the Storage of High-Level Radioactive Waste believes that it is necessary to store the data and documentation⁷⁷ identified as necessary for final disposal for the long term. This is based on the awareness that the documentation of this data is a key safety measure in the entire chain of nuclear disposal and, in particular, for a repository.

Corresponding legal foundations are required to ensure that this is possible. The commission sees the need for further regulation alongside the nuclear and radiation protection regulations already in force. The legal and sub-legal regulations are not sufficient, in particular, to substantiate a duty on the part of the facility operators for the prompt and regular provision of the data and documents to be stored.

Recommendation: The commission recommends establishing a central public body that is primarily a documentation management organisation and stores the relevant data and documents for the long term and has an institutional “awareness” of their significance with regard to safety.

The Atomic Energy Act and the planned radiation protection act should be supplemented with a binding regulation that corresponds to the requirements presented in Part B⁷⁸ or, if necessary, a transitional regulation could be established.

A power to issue statutory ordinances should be incorporated into the principle act to regulate in particular the concrete data and information to be collected by the central public body and to further elaborate the obligations to surrender such data so that these elements can be adapted flexibly in line with current developments.

⁷⁶ Cf. the definition in the preamble of this report, p.23.

⁷⁷ Cf. section B 6.7.1 of this report.

⁷⁸ Cf. section B 8.7.6 of this report.

5.2.11 Enshrining safety requirements in the Repository Site Selection Act

Pursuant to Section 4(2) number 2 in conjunction with Section 4(5) of the Repository Site Selection Act, the commission is tasked with reviewing whether and, if so, how general safety requirements should be enshrined in law. Some of these arise from the commission's proposal on the decision-making bases,⁷⁹ while others are already included in the safety requirements of the Federal Environment Ministry from 2010.

They should therefore be directly enshrined in the Repository Site Selection Act. The commission also recommends newly establishing within the Act powers to issue statutory ordinances to regulate specific safety requirements that are relevant to the site selection procedure and concern the final disposal of heat-generating radioactive waste, or to modify the relevant powers to issue statutory ordinances already included in the Atomic Energy Act for these purposes. This ordinance, to be drafted with the participation of the federal states and the public, must be available by the beginning of step 3 of phase 1 of the site selection procedure at the latest. It should be reviewed at least once every ten years and adapted to latest state of scientific knowledge and technology where required.

5.2.12 Enshrining the phase-out of nuclear power in Basic Law

The question of whether the phase-out of nuclear power should be enshrined in the Basic Law (GG) came up early on in the commission's work and was extensively discussed. The commission came to the conclusion that is theoretically possible to enshrine the phase-out of nuclear power in the Basic Law, but opinion differed as to whether this should be done or not. Enshrinement in the Basic Law would not make the phase-out of nuclear power irreversible but would have a strong de facto binding effect. The ultimately decisive assessment of the benefit provided by the symbolic effect of a constitutional amendment to assuage society on the one hand and reservations about its inclusion in the constitution in line with efforts to depoliticise the issue on the other is a highly political decision that the commission should not and does not wish to prejudice – also in view of its legal mandate. The commission therefore advises the legislator to thoroughly examine the considerations contained in the two expert opinions⁸⁰ requested on this topic by the commission and to incorporate them in its decision.

5.2.13 Shifting the focus of research on final disposal

Research on final disposal in Germany must in future be directed particularly at finding solutions to issues relating to the site selection procedure that have not yet been sufficiently clarified. Such research should, in particular, develop answers to questions addressing:

- The characterisation and non-destructive or minimally-invasive investigation of host rock formations and the development of host rock-specific safety and verification concepts
- The development of repository reference concepts for site selection including provisions for corrective action including retrieval and recovery of final disposal containers

The commission also regards the social science and socio-technical aspects involved in the procedure as a research focus requiring further development. For example in projects such as:

- Accompanying research on participation in a democratic constitutional state
- Topics relating to knowledge management, data retention, and transferring the important knowledge about the repository over long periods of time to future generations and ensuring the comprehensibility of the data and knowledge.

⁷⁹ Cf. verbatim record of the 18th work group 2 meeting of 6 June 2016.

⁸⁰ Cf. Gärditz, Klaus (2016). Should nuclear phase-out be enshrined in Basic Law? K-MAT 61, and: Roßnagel, Alexander (2016). Short opinion on enshrining nuclear phase-out in Basic Law. K-MAT 62.

- Securing and scientifically appraising the experiences gained from the disputes surrounding nuclear power. These should, for example, be documented at the Federal Agency for Political Education and used in the management of other major conflicts. Citizens from the affected regions should be involved in this project.

6 CONCLUSION OF THE SUMMARY

The commission was appointed to lead one of the most difficult conflicts of the last few decades in Germany to a peaceful, democratic and sustainable solution. It is aware of the diverse range of conflicts surrounding final disposal and regards them as an obligation to reach a new common understanding. The commission considers itself bound to the guiding principle of sustainability.

The commission does not regard the safe disposal of high-level radioactive waste as a purely technical task. The best-possible disposal must also consider the social and cultural dimensions of the challenge so that the criteria and the proposals meet with broad consensus in society and are sustainable in accordance with the principle of responsibility. The science-based site selection procedure recommended by the commission therefore takes account of both sides that are required to achieve consensus in society and the best-possible disposal: the quality of the scientific and technical criteria and social modernisation. Both must be considered in one and the same context.

The commission has learned from the history of the four repository projects previously undertaken in Germany. It based its work on ten principles that define the commission's understanding of its work. On this basis, it has made recommendations that range from a commitment to a science-based, open-ended selection procedure up to extensive transparency and public participation. These proposals are intended for the best-possible disposal of high-level radioactive waste but could also serve as examples for the evaluation and management of complex projects in general. The most important insight is that only a transparent, fair and open-ended procedure will find approval. The procedure must aim to achieve as fair a distribution of the burdens and duties as possible and must not appear arbitrary. The objective is to make a genuinely new beginning that enables the development of understanding and trust.

This report is the outcome of our work, which was aimed at making this new beginning possible. It was produced to the best of our knowledge and in good faith, and is the result of countless discussions, differences of opinion and attempts to resolve them. We submit the outcome to the German Bundestag, the Bundesrat, the federal government and society in the hope that this new beginning will lead to a final disposal solution that provides long-term safety.

Figure 1 (p. 22)

Bundestag

Bundesrat

Federal Government

Federal Environment Ministry

Support from society for the search

BfE (Federal Office for the Safety of Nuclear Waste Management)

Technical support for the search

Regional conferences

Subregions and Council of Regions expert conferences

National support body

Participation commissioner Scientific council

BGE (Bundes-Gesellschaft für kerntechnische Entsorgung)

Regional affected population

Population

Figure 2 (p. 33)

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

Technical supervision

BfE (Federal Office for the Safety of Nuclear Waste Management)

Repository regulation

Repository planning approval and authorisation

Repository supervision

Regulation

Administration of participation

BGE (Bundes-Gesellschaft für kerntechnische Entsorgung)

Private law-company – 100% publicly owned

Not tied to public budgets

Implementing agency:

Site selection

Construction

Operation

Decommissioning

Clearing office to create transparency

Waste producers and other institutions

Technical supervision

BfS (Federal Office for Radiation Protection)

Scientific federal authority for aspects of radiation protection

Federal supervision

Cooperation in the LAA (Federal State Committee for Atomic Energy)

Federal state ministries

Nuclear legislation enforcement

Mining operating licences

Organisational framework of the German authorities pertaining to the disposal of irradiated fuel elements and radioactive waste as per implementation of the recommendations of the Repository Commission of 2 March 2015.