

**Site Selection in Germany -  
Status of the Evaluation of the Site Selection Law – 16122**

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**ABSTRACT**

Since 2011 Germany is pursuing a phase out strategy concerning the use of nuclear power for electricity production. This decision was strongly influenced by the Fukushima event. In 2013 the federal government announced that they also had achieved an agreement with the Federal States in Germany on a law to restart the site selection for a repository for spent fuel and high active heat producing waste from scratch. The consequence of this law is a delay of at least two decades to start operation of a final disposal site and additional costs of at least EUR 2.7 billion. The new law was passed in July 2013.

At first a 34-member commission had been installed in April 2014 to evaluate the Site Selection Law [1] and to develop basic principles for site selection, including safety requirements and selection criteria for rock formations. The commission includes representatives from the parliament, academia, civil society organizations, industry, the environmental organizations and trade unions and should forward its recommendations after a delay in starting the evaluation process now in summer 2016. The present law will then be reviewed. The site selection then might start after the next federal election in 2017 at the earliest probably based on a new site selection law. A new repository site should be determined till 2031 and for this site the more detailed site investigation will take place followed by a detailed safety analysis, before the erection of the repository can start. Based on the present procedural steps it seems to be rather unlikely to determine a repository site till 2031. As shown in the publication [2], there will be a delay of at least 20 years compared to the schedule given in the site selection law until a repository site can be determined.

**INTRODUCTION**

After the Fukushima incident and the following repeal of the extension of operating times and the stipulated time limitation of power operations of all power stations, a discussion among the different parties in the German parliament about finding a consensus regarding the disposal of heat generating radioactive wastes took place. The result of the discussion was the “law about the search and the selection of a disposal-site for heat generating radioactive wastes and for the amendment of other acts” [1].

An assessment of the goals of this law and an evaluation whether the goals are accomplishable are part of the law itself. The first step is therefore the evaluation of the site selection act. The 34-member commission installed for this evaluation process started its work May 2014. It is planned that the final report will be published by the commission in the middle of 2016.

This paper presents the present status of the evaluation and the still remaining open questions.

## **DESCRIPTIONS AND DISCUSSIONS**

### **Final Disposal of Radioactive Waste in Germany**

From 1979 until 2013 the salt dome of Gorleben was investigated for the disposal of high active heat generating waste. This site investigation was stopped in 2013 after a new site selection act came into power.

This site selection act has to be evaluated. This will be done by a commission until presumably mid of 2016. It is intended to start a new site selection procedure from scratch including salt, clay and crystalline as host rocks.

Besides for negligible heat generating waste the iron ore mine Konrad had been licensed in 2002. Since then it is transformed into a repository. It is expected that Konrad will start in operation around 2021.

An overview over the German disposal situation is given in TABLE I.

### **Site Selection Process**

The procedural steps to determine a repository site are:

1. A first stage to evaluate the legal regulations and to determine general criteria.
2. Investigation of potential siting regions.
3. Exploration from above ground.
4. Exploration of the underground area.
5. Comparison of sites.
6. Recommendation of one site.
7. Determination of a site by federal law.
8. Licensing procedure for the proof of safety at the defined site based on a detailed underground exploration.
9. Construction of the facility after legal verification of the approval decision, if applicable.

This stepwise approach - including the underground exploration - is based on the German final disposal concept from earlier times. A proposal for an optimization of this process will be presented.

TABLE I. Disposal Projects in Germany

Project	Geological Formation	Purpose	Actual Status	Waste
Gorleben 1979 -2013	Salt dome	Repository for all types of radioactive waste especially high-level and heat-generating waste	All investigations are stopped in 2013  But will take part in the new site selection	17,000 t HLW/spent fuel
New site selection 2017-≥ 2050	Salt  Clay  Crystalline	Repository for high-level and heat-generating waste	Evaluation of the site selection act	17,000 t HLW/spent fuel
Konrad since 1982	Iron ore	Repository for long lived waste with negligible heat generation	Licence issued 2002  Start of operation ≥ 2021  Operation: ≈ 35 years	300,000 m <sup>3</sup> LLW/ILW

At first starting from a “white” German map exclusion criteria will be applied. For the remaining areas, minimum criteria and weighing criteria will be adopted and result in 20 to 30 regions or sites which may be suitable. Among these using safety analyses up to 6 regions will be selected which turn out to be the most suitable candidates for a site investigation from above ground. Based on the results of the site investigations from above ground, 2 -3 sites will be identified as the candidates with the highest expectations with respect to suitability. After a site investigation of the host rock from below ground one site will be selected after safety analyses and proposed to become the site for which the licensing procedure should be performed.

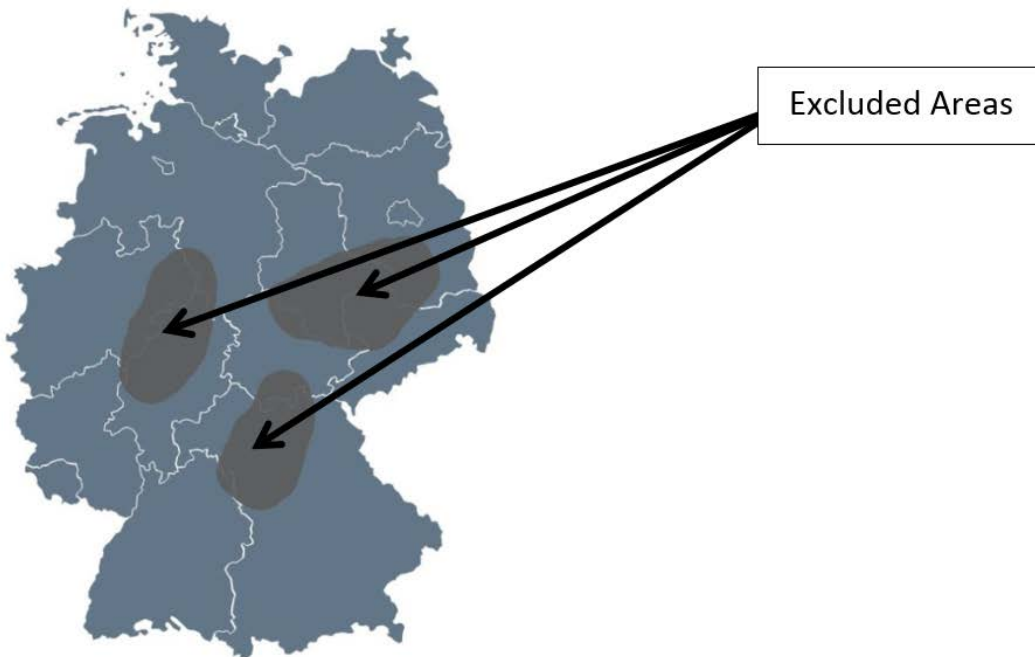
The targets and criteria for the different site selection steps are shown in TABLE II.

TABLE II. Targets and Criteria for the Different Site Selection Steps

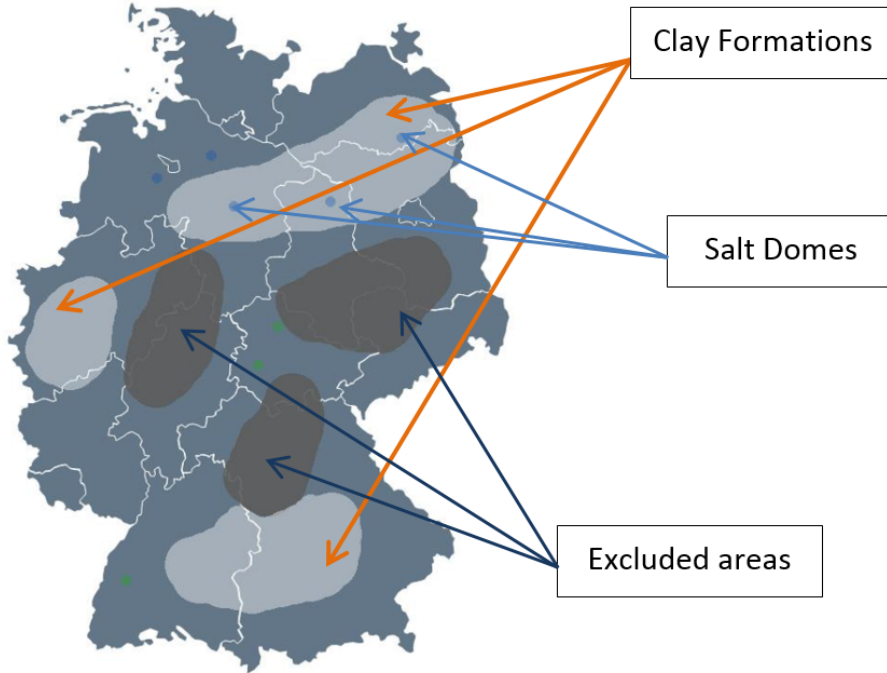
Steps	Targets	Criteria	Results
1	Identification of areas which have to be excluded by exclusion criteria	Geoscientific exclusion criteria	Exclusion of regions which are not suitable
2	Identification of areas which meet minimum criteria	Geoscientific minimum criteria	Identification of regions which could potentially be suitable
3	Areas with especially favorable geological conditions	Geoscientific weighing criteria	20 – 30 regions/sites
4	Selection of regions for investigations from above ground	Safety analyses	5 – 6 sites/regions
5	Selection of sites for deep underground investigation	Screening criteria	2 – 3 sites
6	Comparison of sites	Safety analyses	Proposal of 1 site

In the following pictures the application of the criteria in the different steps are shown in principle:

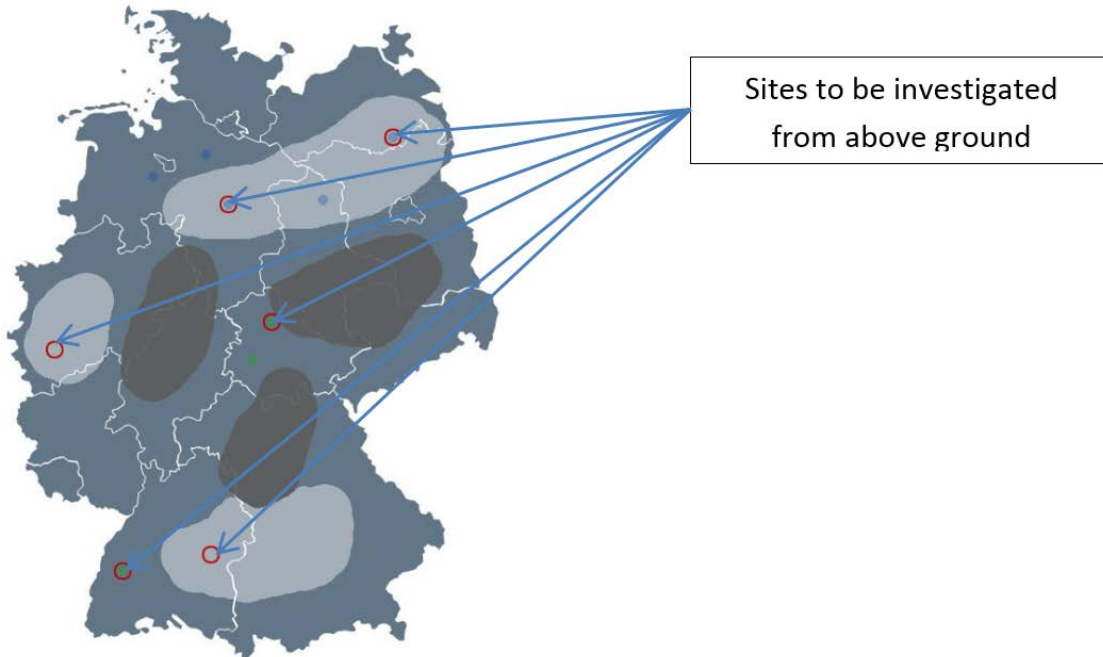
- Step 1: Application the Exclusion Criteria;



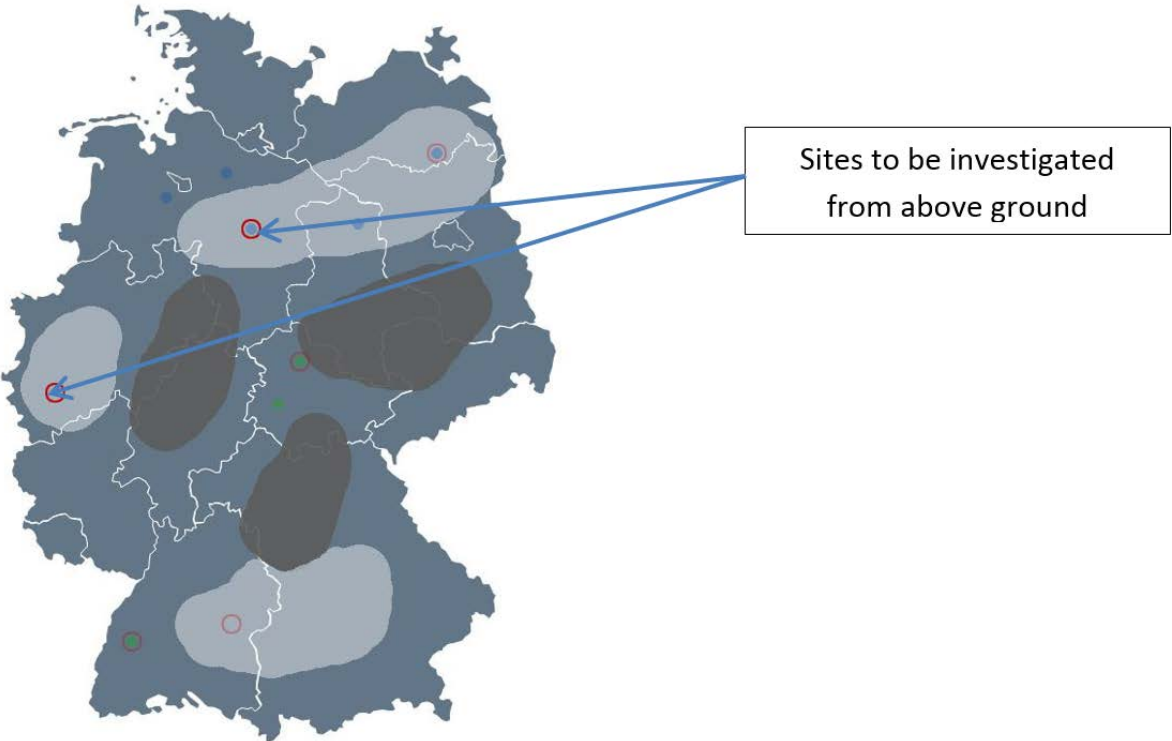
- Steps 2 and 3: Application of the Minimum and Weighing Criteria;



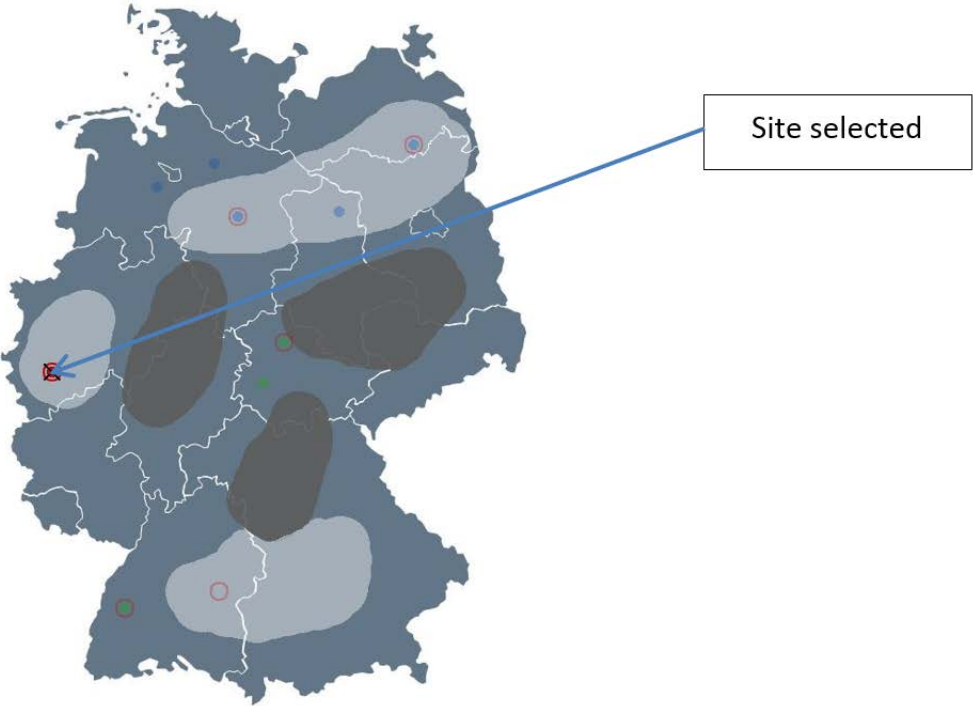
- Step 4: Sites investigated from above ground;



- Step 5: Sites investigated from above ground; and



Step 6: site selected.



The site selection process leads to one site for which the licensing procedure will be initiated.

The target of the site selection process is to find in a transparent way criteria based one site which is expected to then be the best possible solution.

If it would turn out within the licensing process that the selected site cannot be licensed due to safety reasons based on new findings a setback has to be initiated and one has to go back one or two steps in the process depending on the new insights.

### **Paths Forward**

The commission has analysed the different potential solutions to dispose of high active heat generating nuclear waste. The preferred solutions – called path - based on the present state of the art is the final disposal in deep geological formations in a mine.

Besides there are other potential solutions, where the technologies are not yet available but which may turn out as possible technologies for the treatment or disposal of these waste stream. They should be analysed repeatedly after certain time steps.

These so called sub paths are:

- Final disposal in deep boreholes;
- Long term interim storage; and
- Transmutation.

Especially the final disposal in deep boreholes might offer an alternative to the disposal in a mine. But at the moment questions like recoverability or what if the disposal process fails are not yet answered. Here it is intended to watch the technology development.

The commission has sorted out paths like:

- Transport into the outer space;
- Sea dumping; or
- Disposal in subduction zones.

These alternatives are not seen as safe disposal paths and should therefore play no role as a disposal concept.

### **Criteria**

The commission is discussing the geological and societal criteria but agree in the main principle that safety has priority. All other criteria are seen as secondary with regard to this main important criterion. The criteria are differentiated between:

- Exclusion criteria (negative criteria);
- Minimum criteria (these criteria have at least to be fulfilled); and
- Weighing criteria (if regions or sites are equally suitable then weighing criteria are seen as possibility to differentiate with regard to safety or societal reasons between different regions or sites.

The main principles for the site selection process are:

- Safety is of priority;
- Recoverability, reversibility;
- Step by step approach;
- No right of veto of the regions/sites but they should have the possibility that the process have to be iterated by one step;
- Transparency;
- Public participation; and
- Stakeholder involvement.

Also funding principles are discussed and the commission will make a proposal.

There is an intense discussion concerning the public involvement by representative groups. In the next few months the commission will propose a detailed concept for the involvement of the public. New information will be presented in the WM 2016 conference in March 2016.

## **CONCLUSIONS**

The commission intends to finalise the report at the end of June 2016. Many discussions and hearings are on-going at the moment. By March 2016, most of the decisions will have been made by the commission. Therefore it is likely that the WM2016 presentation of this paper at WM 2016 will report the almost final recommendations of the commission.

## **REFERENCES**

1. N.N.; Repository Site Selection Act (German Law), July 23<sup>rd</sup> 2013, (BGBl. I, part I, page 2553), Bonn. 2013.
2. Thomauske, B., and Charlier, F. *Site Selection in Germany – Start of the Evaluation of the Site Selection Law*; Proceedings of the WM 2015 Conference, Phoenix, USA, 2015.