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RESEARCH ARTICLE

# Intergenerational justice starts now: Recognizing future generations in nuclear waste management

Lucas Schwarz\*,<sup>1</sup> 

**Abstract** • Intergenerational justice is an inherent component of nuclear waste management. By looking at challenges of intergenerational justice at various stages of the repository siting process, the following thesis is discussed: Current generations can anticipate notions of intergenerational justice by applying high procedural standards to enable equitable distribution between generations and thus adequately recognize the needs of future generations. Applying high standards in this context means a constantly critical, reflexive, and open process, without bias or selfishness. This requires representative bodies such as the German Council of the Young Generation ('Rat der jungen Generation') that act as a bridge to future generations.

## **Intergenerationale Gerechtigkeit beginnt jetzt:**

*Anerkennung künftiger Generationen bei der Entsorgung radioaktiver Abfälle*

**Zusammenfassung** • Intergenerationale Gerechtigkeit ist ein wesentlicher Bestandteil der nuklearen Abfallentsorgung. Anhand von Herausforderungen der intergenerationalen Gerechtigkeit während verschiedener Phasen des Standortauswahlverfahrens und der Endlagerung wird die folgende These diskutiert: Heutige Generationen können Vorstellungen von intergenerationaler Gerechtigkeit durch die Anwendung hoher Verfahrensstandards antizipieren, um eine gerechte Verteilung zwischen den Generationen zu ermöglichen und damit Bedürfnisse künftiger Generationen angemessen zu berücksichtigen. Die Anwendung hoher Standards bedeutet dabei einen konstant kritischen, reflexiven und offenen Prozess, ohne Voreingenommenheit und Eigennutz.

*Dies erfordert, dass repräsentative Gremien wie der ‚Rat der jungen Generation‘ als Brücke zu künftigen Generationen fungieren.*

**Keywords** • nuclear waste, justice, repository, environmental justice, representatives

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## On the importance of intergenerational justice

Notions of intergenerational justice are inherent to discussions about nuclear waste management. In Germany, the site selection process for a high-level nuclear waste (HLW) repository is ongoing. The target of the process is to find a geological formation that can guarantee the best possible safety for the disposal of nuclear waste for one million years. Additionally, the retrievability of nuclear waste shall be possible for 500 years after the initial deposit.<sup>1</sup> In comparison: The industrial revolution, which can be regarded as the foundation of modern-day Europe, took place around 250 years ago – this societal transformation is unmatched to this day. Social change takes place in shorter periods than the decay of nuclear material.

Current generations have to deal with a burden that was imposed on them by past generations and find themselves exposed to past decisions, that they could not (dis)approve. The legal basis for the site selection process in Germany, the 'Repository Site

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<sup>1</sup> In German legislation there is a difference between reversibility and retrievability. Reversibility comprises the planned technical possibility to retrieve HLW during the operating phase, while retrievability refers to unplanned retrieval of HLW from a repository, Standortauswahlgesetz (RSS-Act), § 2.

Selection Act' (RSS-Act, StandAG) determines the "avoidance of unreasonable burdens and obligations for future generations"<sup>2</sup>. Choi and Matsuoka (2020) note that the forwarding of burdens (and benefits) from generation to generation is unavoidable. Current decisions will affect future generations: In the case of nuclear waste, this means that current generations will need to find a suitable repository site and future generations will bear the risk of a nuclear waste repository, without benefiting, e.g. via 'cheap' energy (Shrader-Frechette 2000). As decisions on energy infrastructure are often determined in a 'moral vacuum' (Jenkins et al. 2018), the inclusion of intergenerational justice requires serious and sincere consideration. Warren (2002) describes, that democratic inclusion relies on the opportunity of affected actors to in-

translates into the debate around reversibility and enclosure for an HLW repository (Ott and Semper 2017).

Gosseries (2008) states that intergenerational justice is achievable if the needs of future generations are not compromised upon by current generations. He argues that the capital (in its broadest sense; not narrowed down to a purely economic capital) that a current generation forwards to a future generation, should not be smaller than the capital that it received from a past generation. For nuclear waste, current generations have to deal with a legacy that was inherited from past generations. Additionally, future generations have to deal with possible consequences of decisions that will (not) be made by current generations. As current generations are future generations to past

### *The inclusion of intergenerational justice requires serious and sincere consideration.*

fluence a decision. Reciprocity is not achievable, as future generations cannot represent themselves personally, but rely on current generations to anticipate their needs: A dilemma arises that needs to be resolved for a nuclear waste repository site to be perceived as just from an intergenerational point of view.

The following thesis will be discussed: Intergenerational justice can be enabled by setting high standards in the procedure, distribution, and recognition within the current site selection process. The qualifier high describes that standards need to be critical, reflexive, and open for adaptation without bias or selfishness. Hence, justice for future generations is intrinsically linked to justice in current generations. Additionally, I provide challenges and opportunities for the long-term perspective of intergenerational justice.

### State of research

Questions of intergenerational justice typically revolve around the extent of current generations' responsibilities (Blowers 2010), whether it is fair to deprive future generations of their flexibility (Leigh and Dotson 2011), or whether an inclusive discourse with future generations is possible. Spaemann (2003) states that merely a fictional dialogue is possible. Hocke (2021) complements that such a discourse is entirely in the hand of current generations, thus revealing a power asymmetry between current and future generations. Even in current generations, many different approaches fit the idea of acting responsibly towards future generations by either granting flexibility or freedom. This

generations, and the nuclear waste legacy was forwarded, the inherent challenge of nuclear waste to notions of justice becomes apparent.

Liebig and Scheller (2007) attest that not only goods but also burdens need distribution and that the perception of justice of such distributions is based on different ideals of justice. Nonetheless, unequal distributions between people and generations require reasoning and explanation (Berger 2004). This is necessary for the repository, as all German HLW shall be stored in a central repository.

Tremmel (2021) describes two major concerns of intergenerational justice as the contradiction between (forgone) welfare and sovereignty. This is transferable to nuclear waste management: Kermisch (2016) provides an overview of different disposal options and differentiates between close and remote future generations. She concludes that "non-retrievable geological disposal appears to be the most favorable option for remote future generations" (p. 1809), but shows simultaneously that close and remote future generations might have different needs for a repository. The assessment between generations on how to interact with nuclear waste is therefore subject to temporal change (Kasperski and Storm 2020). Tremmel (2021) argues in favor of 'institutions for future generations.' This can be enabled by improving the political representation of children as links to future generations (Campos 2021). This representation needs to be understood as a representation of claim rights (Campos 2019).

Reversibility enables future generations to act flexibly regarding nuclear waste management thus granting them sovereignty over HLW, whereas enclosure grants a higher degree of freedom, without the obligation to act and thus to focus on then prevailing challenges. From another perspective reversibility can be regarded as a burden, as future generations might have to deal with HLW; while enclosure can be regarded as an obsta-

<sup>2</sup> Repository Site Selection Act of 05.05.2017 (BGBl. I p.1074), as last amended by Article 1, Section 2 of the Act of 07.12.2020 (BGBl. I p.2760). Available online at [https://www.gesetze-im-internet.de/standag\\_2017/StandAG.pdf](https://www.gesetze-im-internet.de/standag_2017/StandAG.pdf) (in German), last accessed on 17.10.2022.

cle to correcting past decisions. The contradiction between reversibility and enclosure requires constant evaluation at fixed times and flexibility regarding the outcome (Tremmel 2017). From a critical perspective, Okrent (1999, p. 878) raises the question of whether “millions of dollars spent today to save a relatively few statistical lives thousands of years in the future,” although this money could be used to save more lives in the present, can be regarded as intergenerationally just. While this question is fundamental, it is equally difficult to answer and will therefore be put aside.

From an environmental justice perspective, Schlosberg (2004) argues that justice is generally made up of three dimensions, namely procedure, distribution, and recognition. Against this background, intergenerational justice can be regarded as a part of recognition, with direct implications for procedure and distribution.

In the following, I discuss that intergenerational justice can be enabled by setting high standards for procedure, distribution, and recognition within the current site selection process.

Intergenerational justice research often thematizes the dilemma or the challenge of reciprocity, representation, or hypothetical wants and needs of future generations. Especially in the case of nuclear waste management, there is a lack of empirical insights to assess how claims of intergenerational justice are manifested. By conducting a quantitative survey that is complemented by qualitative observations, this contribution provides exploratory insights into how intergenerational justice is perceived in the German site selection process.

## Methods

This contribution draws on a quantitative survey carried out among interested citizens in Germany. The presented notions of justice were assessed in a survey that was carried out in the context of the German repository site selection process. 716 respondents were acquired via networking platforms from the ongoing site selection process, political working groups on environmental and energy politics, civil society organizations, as well as interested groups (via Facebook). The respondents were invited via mail or group post and two reminders to participate were sent. Additionally, in online events of the German site selection process, respondents were invited via public chat messages. The anonymous survey covered three dimensions of justice (procedure, distribution, recognition); adjacent factors such as trust, power, and emotions; and personal constituents, e.g. spatial proximity, experiences, and socio-demographics. No-

Aspect	Item	Reference
<b>Recognition</b>	Future generations have to be considered in the siting procedure for a repository.	Gosseries 2008; Hocke 2021
<b>Reversibility</b>	For the sake of future generations, the repository should be kept open.	Kermisch 2016; Tremmel 2021
<b>Enclosure</b>	For the sake of future generations, the repository should be immediately sealed.	Kermisch 2016; Tremmel 2021
<b>Timely solution</b>	A repository must be found quickly, to not burden future generations.	Röhlig et al. 2017
<b>Time delays</b>	The process may take longer than planned (a) for scientific reasons; (b) for participatory reasons.	RSS-Act 2017*; Leigh and Dotson 2011
<b>Young generation</b>	Intergenerational justice comprises the inclusion of the young generation.	Campos 2021, Tremmel 2021
<b>Compensation</b>	The repository community is entitled to generous financial compensation.	Kunreuther et al. 1990; Blowers 2010

\*Repository Site Selection Act of 5<sup>th</sup> of May 2017 (BGBl I, p.1074), as last amended by Art.1 of the Act of 7<sup>th</sup> of December 2020 (BGBl I, p.2760)

Tab. 1: Survey items.

Source: author's own compilation

tions of intergenerational justice were part of six questions (Table 1). All items were formulated as statements. Respondents had to assess on a scale from 0 (low) to 10 (high) how strongly they (dis)approve of a statement. Each item is derived from the indicated sources.

Additionally, qualitative observations (systematic protocols with categories; Lamnek 2010, pp. 564–565) were carried out to gain additional insights. The categories for observations were derived from the RSS-Act. Justice was formulated as an open category. Observations of intergenerational justice were collected within this category. It was captured how actors in the site selection process refer to notions of (intergenerational) justice and future generations. 71 events were observed using systematic protocols, such as the sub-areas conference, (organizational) meetings between the events of the sub-areas conference, and thematic workshops as well as informational events organized by the German Federal Company for the Disposal of Nuclear Waste (‘Bundesgesellschaft für Endlagerung’) or by the Federal Office for the Safety of Nuclear Waste Management (‘Bundesamt für die Sicherheit der nuklearen Entsorgung’). The findings of the observations were used in addition to the quantitative survey results, thus providing an empirical base for interpretation.

## Results and discussion

As the meaning of intergenerational justice varies over time and the progress of nuclear waste disposal, the following section is structured chronologically: pre-siting decision, siting decision, and post-siting decision.

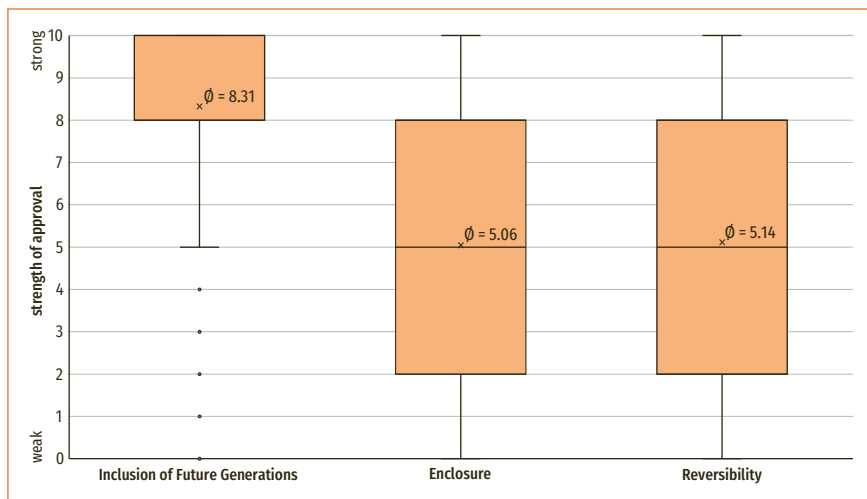


Fig. 1: Statements regarding future generations.

Source: author's own compilation

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### Pre-siting decision

The consideration of future generations is apparent since the initiation of the current site selection process: The 'Repository Commission' wanted to achieve the least possible burden for future generations but at the same time to enable reversibility and retrievability (Röhlig et al. 2017). In the RSS-Act three time horizons are defined: (1) a repository site shall be found by 2031; (2) retrievability shall be possible for up to 500 years after enclosure; (3) nuclear waste has to be safely encapsulated for one million years<sup>3</sup>. Most actors assume that the first date is utopian and lately the Federal Company for the Disposal of Nuclear Waste has issued a statement that the repository will probably be found between 2046 and 2068 at the earliest.<sup>4</sup> Usually, discussions revolve around the 'one million years,' a humanly unimaginable time. The second period of 500 years is rarely thematized. Most actors focus on contemporary events, such as the conflict in Ukraine that strongly influences how people perceive the necessity to deal with nuclear waste (Brunnengraber 2022). Some actors call for a faster process while others emphasize the short-termism of societal events and insist on a solid scientific base for the site selection. Röhlig and Eckhardt (2017) insist that such ephemeral trends should not influence the safety or scientific base of the site selection.

Generally, the respondents approve that the wants and needs of future generations have to be considered in the site selection process ( $\bar{x} = 8.31$ ,  $SD = 2.71$ ). This general approval is manifold in its implications. There is no clear tendency whether enclosure ( $\bar{x} = 5.06$ ,  $SD = 3.42$ ) or reversibility ( $\bar{x} = 5.14$ ,  $SD = 3.39$ ) is regarded as intergenerationally just. For both options all as-

essments were chosen by the respondents, thus showing that the actual path to achieve justice for future generations in this aspect is unclear.

The respondents do not attach any particular importance to a timely site decision ( $\bar{x} = 6.45$ ,  $SD = 2.99$ ). Delays due to scientific reasons ( $\bar{x} = 8.34$ ,  $SD = 2.20$ ) are more strongly approved, than delays due to participatory reasons ( $\bar{x} = 7.77$ ,  $SD = 2.58$ ). This result is observable in the site selection process as well: Whereas in the 'Sub-areas Conference' (February-August 2021) many discussions revolved around how and when citizens can participate in the process, the last participatory conference – the 'Repository Siting Forum' (May 2022) – strongly revolved around methodological questions.

An important development regarding intergenerational justice is the (bottom-up) foundation of the 'Council of the Young Generation' which aims to involve young participants in the site selection process. The council members argue that young people will actually experience the implementation of the repository and are therefore affected more strongly. Such institutions can help to build a bridge to the next generations if carried out constantly throughout the process (Campos 2021). This development provides an example of how procedural justice in the current process contributes to intergenerational justice in the future. The inclusion of younger generations is assessed positively by the respondents ( $\bar{x} = 7.28$ ,  $SD = 3.12$ ). Such developments aim at long-term inclusion.

Through the establishment of the 'Council of the Young Generation', procedural justice has the potential to keep the procedure on a just path, exemplarily against short-termism or societal shocks. By applying high procedural (and scientific) standards, if society is accepted as a corrective of the site selection process, a responsible foundation for future generations can be laid. This requires continuity, as well as a flat (non-hierarchical) power relation between all involved actors (Schwarz et al. 2021).

### Siting decision

The siting decision in Germany will be accompanied by a site agreement that comprises the definition of compensation for the affected host community. Kunreuther et al. (1990) have shown in the case of the U.S. that compensations can only work when the affected population has been able to convince itself that compensations do not function as bribes and that the process has a scientific basis. Lehtonen (2021) describes the kind of compensations that were carried out in the Finnish case; e.g. a senior residence, credits for an ice stadium, and economic development. In Switzerland, compensations are intended for the sustainable development of the host region and comprise 500 million CHF for a high-level waste repository site (Steinebrunner 2019).

3 StandAG, §1 (2,4,5).

4 The statement is available here: [https://www.base.bund.de/SharedDocs/Kurzmeldungen/BASE/DE/2022/zeitplan-endlagersuche.html;jsessionid=3EF4AD06D83CCD5356C3AF7FD3457A8C2\\_cid382](https://www.base.bund.de/SharedDocs/Kurzmeldungen/BASE/DE/2022/zeitplan-endlagersuche.html;jsessionid=3EF4AD06D83CCD5356C3AF7FD3457A8C2_cid382) or here <https://www.bge.de/de/aktuelles/meldungen-und-pressemitteilungen/meldung/news/2022/11/bge-tritt-in-die-diskussion-ueber-den-zeitplan-bei-der-endlagersuche-ein/>.

Compensations can be designed differently, which directly influences intergenerational justice. The need to compensate the host community is slightly approved ( $\bar{O} = 6.99$ ,  $SD = 3.00$ ), but its implementation is contested: According to observational insights, actors of the anti-nuclear movement argue that compensations are necessary, but timing is crucial to avoid misuse of the mechanism. Compensations shall function as a mechanism to additionally develop a region that took responsibility for a national task. The height and mode of compensation cannot be part of the discussion before the site decision but only after the decision has been made. This only works if the participatory process is regarded as trustworthy (Seidl et al. 2013) and if compensa-

2002, p. N/A). To communicate with future generations, different semiotic warning signs are considered.

Figure 2 symbolizes ideas to mark the repository site by repelling instead of attracting. The most prominent example is the ‘Landscape of Thorns’ (E) which “conveys a menacing aura of danger through its stylized inelegance and a repudiation of high-tech origins” (Bryan-Wilson 2002, p. N/A). Although the repository is a deep-geological structure, such a monument would be above-ground, thus effectively changing a landscape for the duration of its existence.

From an intergenerational perspective, such measures are imaginable, but their assessment of justice is ambiguous. The

*Nuclear waste knowledge preservation, e.g. by an atomic order or priesthood, seems necessary, but any entity made up of people can potentially be corrupted or destroyed.*

tions are not used as an incentive for structurally or financially weaker municipalities. Distributive justice for future generations can be achieved if externalities do not influence the siting decision. Exemplarily, the East German politician Kai Emanuel argues that structural change cannot end in a final repository in the East of Germany (NSDO 2020). A citizen forum on compensation might help to include the needs of future generations by including the Council of the Young Generation.

### Post-siting decision

Most currently living generations will not live to see the German repository. Scholars and state actors deal with the heritage of a nuclear waste repository. Heritage research deals with how people in the future can be warned of a repository site when the memory of its location will be lost. Kermisch (2016) estimates that such memory loss will happen approximately 500 years after closure. Questions of responsibility during this phase are rarely discussed in the ongoing site selection process. In contrast to this, different risks of accidentally causing damage to the repository have been discussed, such as accidents while drilling for geothermal energy or salt caverns. Such risks are – again – hypothetical, but taking precautions today is one way of considering the needs of future generations. One component of intergenerational justice is the safety of the repository from geological and human activities. While geological dangers will be addressed within the site selection process, human intrusion “poses the only real danger to [a] site’s integrity” (Bryan-Wilson

‘Landscape of Thorns’ can be compared to ancient (from a current perspective) burial places that were intruded upon by Westerners. Danesi (2022) describes that warning signs change over time. They should therefore be re-designed constantly to ensure the repository’s integrity from human intrusion. This constant attention poses challenges to intergenerational justice, nuclear waste knowledge preservation, e.g. by an atomic order or priesthood, seems necessary, but any entity made up of people can potentially be corrupted or destroyed. Such a project is already imagined in fictional novels (Hug 2021).

A monument is neutral but since there is no immediate threat from a repository, the question remains whether it only burns entire landscapes and creates emotional relations. Such questions can be answered by current generations, but need re-evaluation by future generations to guarantee future applicability. Therefore, intergenerational justice is – again – intertwined with jus-

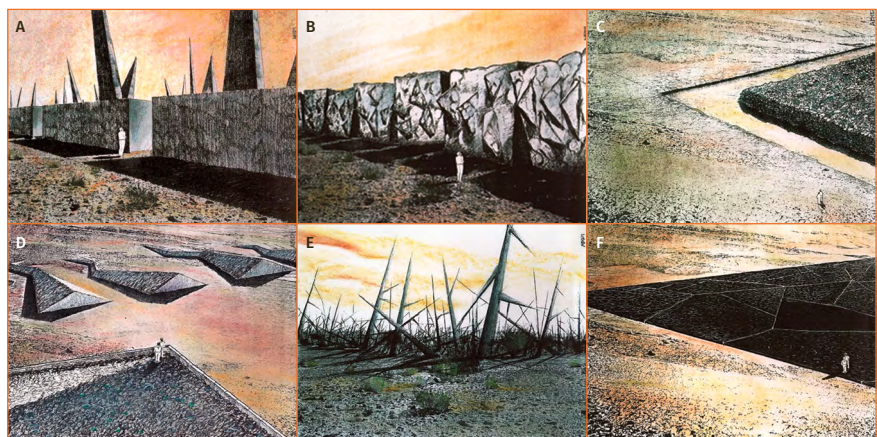


Fig.2: Monuments to prevent human intrusion into the repository.

Source: Bryan-Wilson 2002

tice in current generations. As potential problems do not need to stem directly from the deep-geological repository site the questions of the monument's location additionally requires consideration – alongside its implications for distributive justice in current and future generations.

## Conclusion

The contradiction between enclosure and reversibility or phrased differently between (forgone) welfare and sovereignty (Tremmel 2021) is at the core of intergenerational justice for an HLW repository. The survey has shown that the respondents generally approve of including the needs of future generations in the site selection, but the actual implementation is contested. Following the findings of Campos (2021), first positive developments regarding intergenerational justice are observable in Germany, especially by the foundation of the Council of the Young Generation. Such an institution can help bridge the gap between current and future generations but requires constant participation and interest from young(er) participants. This is important as the council can embody a proxy for the abstract concept of future generations. By installing such a representative body, reasoning and explanations for unequal burdens can be critically discussed and improved (Berger 2004).

Bridging mechanisms and institutions are necessary: as Kermisch (2016) described how distant future generations might favor a certain type of repository, her assessment is based on certain assumptions made from a current point of view. Re-evaluation is necessary until a final decision needs to be made. Some paternalism of then-current generations toward future generations is inevitable, as future generations are affected by both in-decision and actual decisions. By setting high standards for the site selection procedure, distribution, and recognition, current generations can enable a solid basis for future generations. As high standards comprise criticalness, reflexiveness, and openness for adaptation without bias or selfishness (derived from justice literature), they are subject to constant evaluation throughout the site selection process.

In this context, it is necessary to establish the Council of the Young Generation as a constant part of the site selection procedure. This council can act as a corrective and a reminder of the impact on and needs of future generations, as well as a proxy for their sovereignty in the site selection process for an HLW repository. This is necessary as current generations cannot solve this challenge alone, due to the longevity of HLW.

Whenever intergenerational justice is envisioned, it lays the groundwork for how other dimensions of justice will be approached in the future by people who have never benefited from nuclear energy but may have to deal with nuclear waste decisions. Such decisions will have to be made, especially if a flexible solution for a nuclear waste repository is chosen in the coming years (e.g., repository with retrievability or aboveground long-term storage). To achieve intergenerational justice, cur-

rent generations must lay the groundwork by implementing a procedurally fair process with an equitable distributional outcome by recognizing the potential needs of future generations.

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