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Kontakt

Dr. Peter Hocke
Institut für Technikfolgenabschätzung und Systemanalyse (ITAS)
Karlsruher Institut für Technologie (KIT)
Karlstraße 11, 76133 Karlsruhe
Tel.: +49 (0) 7 21 / 6 08 - 2 68 93
E-Mail: hocke@kit.edu

Guaranteeing Transparency in Nuclear Waste Management: Monitoring as Social Innovation

Introduction to the Thematic Focus

by Peter Hocke, ITAS, Anne Bergmans, University of Antwerp, and Sophie Kuppler, ITAS

Any activity involving radioactive materials, in industry, research, medical applications, and most notably nuclear power production, produces radioactive waste. The high level (life threatening doses of radiation) and long lived (radiation levels remaining intact up to 100.000 and even millions of years) wastes mainly from nuclear power plants, are thought to be too dangerous to keep forever within society, as they would need continuous (re)treatment. Therefore, already in 1957 the US National Academy of Science suggested deep geological disposal as the safest way to dispose of this type of waste (NAS 1957).

In the long-lasting debate on how to best implement such a geological repository, "monitoring" is a central aspect currently under discussion. Mostly, the term refers to the technical gathering of data about the way, in which the repository and its surroundings develop. But also related societal processes of making sense of the technical data, and putting the act of monitoring in a context of responsible care or continuous vigilance, are part of the debate.

1 The Need for a Change in Strategy

Until fairly recently, in countries like Switzerland, Germany and Belgium, the general idea was that the construction of a deep geological repository could be realized in a straightforward way and an inherently safe repository could be constructed within two to three decades.

With the concept of geological disposal becoming more concrete, the notion of an immediately maintenance-free repository has been more and more challenged. The original, simplified vision of a relatively quick sequence from licensing and constructing, over operating to fully closing a

facility, has proven unrealistic in some countries. Several changes in strategy, blocks in decision-making, protests and other unforeseen obstacles, including technical ones, have prolonged this endeavour and will probably continue to do so in future (e.g. Hocke/Renn 2009; Rosa et al. 2010). Furthermore, the estimated operational lifetime of a facility, or in any case the period after emplacing all the waste, but before the final closure of the entire facility, seems to be augmenting in most cases from a few decades to at least a century. On top of that, people worry about whether long term safety claims will indeed hold after final closure of a geological disposal facility.

Reflecting this, the call for a more precautionary oriented approach became more prevalent. In the debate, different aspects of this approach get emphasized. One is that the incredibly long timeframes involved make it impossible to call any management option, even if assumed to be definitive or final, a solution. Indeed, it will not be revealed to anyone living today (nor to the next few hundred, if not thousands of generations) whether the concept of passive safety through geological disposal actually worked or not (cf. Berkhout 1991). Therefore, not everybody is ready to put unconditional trust in geology, a sentiment that tends to get reinforced by negative experiences with former safety analyses – e.g. in the German case, the problems with the disposal site "Asse", a former research laboratory, which was used for disposal at the end of its operation phase – influenced this shift in perceptions (see Regenauer et al. in this issue). Furthermore, it is often pointed out that the state of the art of science and technology, but also societal demands regarding the characteristics of a planned repository, can change over the period of time between siting and closure. Also, the possibility that one day the nuclear waste could be reused by future generations is mentioned in some countries as an additional reason, calling for more build-in flexibility in the design and implementation of geological repositories.

Although somewhat reluctantly, the nuclear waste management community seems to have started to embrace the notions of "reversibility" (the ability to reverse decisions) and "retrievability" (the ability to retrieve the waste from the repository) as necessary, but temporary, conditions to attain the final goal of passive safety.[1] Indeed, it is today more widely acknowledged, even among the strongest believers in geological disposal, that the strived for status of passive safety will not be obtained instantly, and that the end of operations of a disposal facility will be just as much a social and political decision, as it will be a technical one. Calls for transparency and dialogue in decision-making, which should enable communication about different problem perceptions and framings, become stronger.

2 Monitoring as a Solution?

In this situation, monitoring, understood as any kind of follow up on the behaviour of a repository and its natural and social environment, could get a more prominent role in the processes of radioactive waste decision-making, as regional politics, authorities and civil society will be interested in control on safety issues. The exact role monitoring will play is still unclear, but the expectation of transparency is attached in all cases. However, monitoring will not per se be able to fulfil the promise of leading to a higher degree of transparency regarding the safety level of a built repository. This expectation can only be fulfilled if technical monitoring provides the information base needed for identifying options for decision-making. The social processes needed to translate the technical monitoring data into options can be called "social monitoring". The institutions needed to guarantee social monitoring have to be planned and invented soon. Institutionalizing social monitoring necessitates the development of a "social innovation".[2] Those social innovations need to address issues such as processes of governance, knowledge management over decades, and finding accepted decisions under more "open" conditions, i.e. with increased public participation.

Implementing such social innovations is a difficult task. One challenge is for example the identification of a working definition of what "guaranteeing transparency" implies in practice. Many institutions with different working cultures and different ideas of what transparency means would need to be involved and would be forced to transform their daily-life conceptualizations into robust compromises. Further challenges are the combination of formal and informal structures of

decision-making needed for meaningful participation (see Swyngedouw 2005). Also, giving up the idea of a maintenance-free repository implicates the shifting of duties and responsibilities to future generations while for a long time, solving the nuclear waste problem within the current generation has been considered a primary aim.

3 Debating Monitoring

Our aim here is to explore the notion that every case of monitoring includes more or less complex social processes. They can differ in the way, in which civil society organizations and stakeholders are included, but they always rely on processes of knowledge generation and knowledge management.

The current discussion on monitoring is still in its early stages and focuses to a large extent on technical monitoring; it has not yet reached full maturity in the public debate, but takes place mainly within responsible organizations and in international forums such as the International Atomic Energy Agency (IAEA), the OECD's Nuclear Energy Agency (NEA) and the International Commission on Radiological Protection (ICRP), or dedicated EU research projects such as an FP5 Thematic Network on monitoring for geological disposal (2001–2003), and the FP7 project MoDeRn (2009-2013) (e.g. IAEA 2001; IAEA 2011; NEA 2011; ICRP 2011; EC 2004; MoDeRn 2010; Mayer et al 2012). As the topic is very close to practical questions of implementation, there could be the danger of a "new technocracy" evolving. Reflexive discussions in social sciences (e.g. Crouch 2011; Rifkin 2011; Grande 2012) show, that the analytical results from research about new governance and other inclusive forms, which integrate the expectations of stakeholders and civil society organizations, do not allow for too optimistic interpretations. In many cases the new deliberative forms of debate and discourse will not pacify the conflicts around nuclear waste.[3] Still, in the context of problem-oriented research there seems to be value in reflecting the opportunities of integrating forms of technical with forms of social monitoring. This could strengthen the advantages of a stepwise approach of site selection and planning, the operation phase (in which the waste is emplaced in the repository), the phase of preparing and executing closure, and the phase after closure. These advantages and problems are reflected in this thematic focus. Scientists, regulators, and industry get a say on their point of view on what monitoring means to them, what the dilemmas and problems are and what role monitoring can play in nuclear waste management.

4 Outline of this Thematic Focus

Beate Kallenbach-Herbert and Stefan Alt commence by giving an overview of central fields of discussion. They show that monitoring can have different purposes, also dependant on the respective phase of repository construction, and highlight that it needs to be clarified what purpose it should have in a specific case before it is implemented. This seems like a trivial statement, but experience shows that it is not. An integrated monitoring concept is supposed to help with this, integrating technical with social monitoring. Their thesis is that even the technical questions are not yet solved.

Also in this context Anne Bergmans, Mark Elam, Peter Simmons and Göran Sundqvist frame the nuclear waste problem as a "socio-technical" one. They strengthen the helpfulness of this approach for the international debate. The EU-project "MoDeRn" addresses issues of technical implementation and stakeholder engagement. It takes an empirical approach by analysing national experiences in order to filter out lessons learned. Such an approach can be very helpful in identifying country specific challenges. In their storyline, they focus on perceptions and expectations different stakeholders have, drawing on discussions set up in Belgium, Sweden and the UK. Different stakeholders attach different meaning to monitoring and consider different approaches to be meaningful or not. They highlight that the general call for "solution in our generation" is too short-sighted.

The German "Gesellschaft für Nuklearservice" and the Federal Agency for Radiation Protection ("Bundesamt für Strahlenschutz") report about their experiences in two specific cases of monitoring: The monitoring of waste canisters in interim storage facilities and the dangers for the waste in final storage in the Asse-II mine, which experiences groundwater inflow and instable geology.

Hannes Wimmer, Klaus-Jürgen Brammer and Michael Koebl review international and national guidelines as a basis for their strategic

perspective on technical monitoring. As a service agency for the power industry, they have to take care of civil waste in interim storage facilities. They argue that the possibilities for monitoring are limited by technical constraints, which are determined by the respective phase of repository construction and closure. They pick up the question of social acceptance of repositories and the role monitoring can play from their point of view.

Experiences with the Asse-II mine are described by Urban Regenauer and Christiane Wittwer. The former mine and research laboratory was given to their custody when water had already started to intrude over a longer period of time. In this particular situation their focus is on guaranteeing radiological safety. The interesting aspect is that their activities are taking place in a complex procedure, in which public participation (Asse-II Begleitgruppe, etc.) is a central feature.

This for Germany new approach hints at the importance of thinking about institutional arrangements, which shape the interface between technical and social monitoring. In that respect, Sophie Kuppler and Peter Hocke argue that Switzerland is taking a relatively modern approach with their plans to test monitoring using a pilot repository. They include in their reflection the institutions of public participation, which are built up already during the current site selection process "Sachplan". The authors highlight the complexity of the task, which includes big challenges in the processes of interest articulation and aggregation. Despite those positive starting points, it is obvious that the concrete planning for monitoring activities including the technical setup and operational plans are still in preparation. The institutional regime for guaranteeing quality in transparency has not been outlined yet.

In difference to the authors above, Detlef Appel and Jürgen Kreusch start with the necessity of the retrievability option. From this point of view they discuss challenges of (technical) monitoring, which is supposed to give information on whether the repository is performing as it should after closure. In commonality with other authors they see the specific purpose of monitoring in building public trust in the repository system, but warn against thinking that monitoring will per se be able to fulfil this task.

If monitoring is a means to solving a problem, the question is: how can the problem be conceptualized and what can be learned from this for nuclear waste governance? Achim Brunnengräber, Lutz Mez, Rosaria Di Nucci and Miranda Schreurs suggest framing the nuclear waste problem as a "wicked problem", which implies that a solution cannot be found without involving the public. They see an analysis of multi-level governance as central to understanding the interplay between different actors, but caution against underestimating power relations. A further challenge they identify is the difficulty of keeping up with transparent processes also during "difficult times" and over long periods of time.

Studying empirical cases can help in identifying challenges for such long-term repository governance. Catharina Landström and Jan-Willem Barbier explore what has been formulated as key conditions by (potential) host communities of nuclear repositories. The conditions identified are continuous transparency, follow-up, and monitoring. They discuss the challenges of achieving those conditions by basing their arguments on observations of what goes on in the Belgian local partnerships involved in the process of design and implementation of a low- and intermediate-level waste facility. Of particular interest are current events in the facility and questions related to decision making on facility closure, which are currently addressed. They argue that while the stored wastes are different to a repository for high-level waste, the time span between construction and closure of this facility will be of comparable length, which would allow for a transfer of lessons learned.

5 Outlook

It would be naive to expect that an opening up of the debate on nuclear waste management, which could theoretically be achieved by monitoring, will generate acceptance. This applies esp. in cases like Germany, were polarized conflicts have lasted for over four decades. They led to extreme cleavages between central actors and industry and governmental organizations constantly following a "muddling-through" strategy in their attempt to generate public acceptance (Hocke/Renn 2009).

Just like in climate change policy, countries which possess nuclear waste need social fantasy to develop new institutions, which are capable of

picking up, tolerating, and dealing with conflicts in a future oriented manner focussing on. Keeping such institutions working over decades is an additional challenge. Still, strategic planning and discourses about directions for future development (here the future of radioactive waste) are necessary tasks in modern societies (Grunwald 2012, esp. pp. 19–26 and pp. 55–88). Whether science oriented experts, governmental organizations and civil society feel sufficiently responsible to mobilize for a transparent reconstruction of the old, conflict-laden processes remains an open question. Prospective technology assessment and Science and Technology Studies face this challenge by providing analytical insights and offering knowledge for necessary strategic decisions.

Notes

1) For a conceptualisation of these notions s. NEA 2012.
2) Brigitte Geissel uses the term "participatory innovation" for innovations in complex governance systems. In the context of the societal discourses about nuclear waste disposal we understand this conceptual frame as a form of social innovation, as in current nuclear waste management society is increasingly integrated in processes of decision making (see Geissel 2009).
3) See the reaction on studies like Streffer et al. (2011) with the idea of "Gorleben plus", which was to continue explorations at the Gorleben sit ein order to be able to decide on its suitability as a repository for high-level/heat-generating waste and at the same time start above-ground explorations at alternative sites. Those kind of ideas may be successful on the long hand, but do not influence the current societal discourse about nuclear waste policy very strongly.

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Contact

Dr. Peter Hocke; Email: hocke@kit.edu