Markers and Deep Geological Repositories - Learning within the OECD/NEA Project on the Preservation of Records, Knowledge and Memory across Generations – 14589

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ABSTRACT

The idea of marking radioactive waste disposal sites surfaced early on in thinking about long-term radioactive waste management, and has re-emerged in current discussions surrounding geological disposal and Records, Knowledge and Memory (RK&M) preservation across generations. The OECD-NEA RK&M project has held discussions on this topic during its project meetings and workshops and has sponsored two studies: a literature review on markers in radioactive waste disposal and reflections on the role recently played by traditional tsunami warning stones in Japan.This paper provides the main observations on the topic of markers as formulated throughout the first phase of the RK&M project.

INTRODUCTION AND BACKGROUND

The OECD-NEA RK&M project[1] glossary [1] defines a marker as a long-lasting object that indicates an area of influence, power or danger. It may be deployed visibly or placed strategically so that it is discovered at a proper, later time. Markers are conceived to be immobile (i.e. in permanent association with a site) and robust (in order to maximize survivability on its own). A marking system can range from a simple stone to a contrived and monumental multi-component system.

A literature review reveals that much debate on markers took place in the USA in the 1980s, with additional, more international debates in the 1990s. Summarized, this historical literature views markers as objects that should remain intact for timescales reaching thousands of years and whose presence and warning message far into the future would ensure the deterrence of human intrusion into geological repositories. The literature reviews concludes that "*Generally the opinion is that a warning message should be designed to last for around 10,000 years, although there is little justification in the literature for selecting this timeframe*" and that "*Practically all authors come to the conclusion that markers alone cannot prevent the intrusion into a repository*".[2]

In the context of the application and granting of a licence to operate for WIPP, in the mid-1990s, ambitious plans were drawn up, focussing notably on grandeur or impressiveness to fulfill the markers' warning function and on the engineering needed to comply with the long timespans foreseen. Against this background, US DOE's plans up until now have mainly focussed on technical and material issues. As the time for implementing markers draws near, the financial implications of such plans have come to the fore.

[1] http://www.oecd-nea.org/rwm/rkm/

Reoccurring questions on markers, however, relate not so much to the technical, material level, but deal more with the marker message and whether it would not simply be ignored or misunderstood even if the marker itself was to remain intact, be it due to misinterpretation, arrogance, or other reasons [2, 3].

DISCUSSION

Current thinking in the framework of implementing geological repositories has opened up the topic of markers to the broader theme of Records, Knowledge and Memory preservation across generations. Within the OECD/NEA RK&M project, consensus is that the conceptual and material work on markers needs to be embedded within a systemic approach [1] to informing future generations. The systemic approach should deploy a variety of practical means that aim to complement each other, provide for redundancy, and maximise the survivability of a recognisable message [4]. Part of such a systemic approach would be to apply a dual-track strategy [1], focussing not only on the passive, non-mediated transmission of messages without the intervention of in-between generations (namely, delivering messages directly from the present time provider to the future receiver, without intermediaries), but also including active, mediated transmission routes, in which messages would be passed on from one generation to another. Such a systemic approach would also include, for instance, the creation of socio-cultural links between repositories and local communities. Situating markers within such a systemic approach could shed a different light on current prevailing conceptions about markers.

Markers as part of a systemic approach

In a dual-track strategy for RK&M preservation, markers have mainly been described as an option to provide messages directly to future generations in the long term, without the help of intermediate generations. The focus today, however, is shifting towards actively maintaining memory and even including the host community in preparing and maintaining RK&M [4,5]. Against this background, markers could play a role in linking non-mediated and mediated RK&M preservation processes.

Two options have surfaced throughout the OECD/NEA RK&M project so far. The first one would be to embed markers in mediated, memory regenerative processes. A variety of ideas have been brought forward, such as including the existence and meaning of markers into the educational system [3], integrating the use of markers in restricted land use functions as US DOE Legacy Management is already doing [6], making markers part of a reoccurring ritual [7], etc. The second option would be to conceive the markers themselves as objects that require renewal and regeneration and providing the opportunity for this to happen [8].

Marker messages

One of the important principles of the RK&M project is that future generations have the right to be informed. The RK&M project thus supports the idea that markers, if used, should be part of a concerted effort to inform rather than simply scare future generations. Depending on their material, structural design and intended time scope, the messages markers are intended to carry can range from ‘this is man-made’ to much more elaborate messages.

Time issues

At present, the use of markers is stipulated in legislation in Switzerland and in regulation in the United States [9].

In the United States, the Code of Federal Regulations on passive institutional controls states that "Any compliance application shall include detailed descriptions of the measures that will be employed to preserve knowledge about the location, design, and contents of the disposal system. Such measures shall include: … Identification of the controlled area by markers that have been designed and will be fabricated and emplaced to be as permanent as practicable …" [10] From this description one can derive the understanding that markers are seen, in the first place, as aids to institutions during the lifetime of their existence and, in the second place, as fulfilling a warning function once the institutional control may no longer exist. This understanding of markers is similar to the one being used today by the US DOE Office of Legacy Management, and it is quite possible that land control provisions will be applied in a number of countries and that markers may be used as an aid during the institutional control period in those countries.

In Switzerland, the Nuclear Energy Act of 21 March 2003 stipulates that a "repository be permanently marked."[11]

The issue of the efficacy of markers over the longer timescales does not seem to have been resolved in the literature. "*Practically all authors come to the conclusion that markers alone cannot prevent the intrusion into a repository*". [2] For instance, they could instil curiosity and favour intrusion.

The study of Tsunami Stones, for example, does not give clear cut indications: markers may be heeded to, or ignored, or destroyed. These possibilities seem equally probable over time. One may therefore ask how reasonable is it to have "permanent" markers as a regulatory requirement? How credible and enforceable would the relevant regulations be?

CONCLUSIONS

The RK&M project members agree that markers may well be used in the medium term [1], e.g., in the period of oversight that will follow the closure of a repository. This period may last a few centuries. As for the longer timescales, even if it is technically possible to find or manufacture marking materials with a very long lifetime, it is notably the passing of messages over long timescales that needs more reflection.

There are at present no conclusive answers to the objectives, messages and methods of marking for the longer term. It is acknowledged that even if markers are to remain intact and traceable over time, future neglect or misunderstanding of their message cannot be ruled out. Misunderstanding may come not only from a natural shift in languages and in cultural and aesthetic interpretations, but also from disbelief or conscious manipulation [2]. This is a risk both if a marker is conceived as a non-mediated RK&M tool and if it is conceived as (part of) a mediated process [2,3].

In any event, the RK&M project members judge markers, on their own, not to be sufficient to pass on the information that future societies may need to make their own decisions. This is why the RK&M project supports the idea that markers, if used in national programmes, should be integrated into a systemic approach to RK&M preservation across generations.

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