

Preservation of RK&M in the long term: Project findings

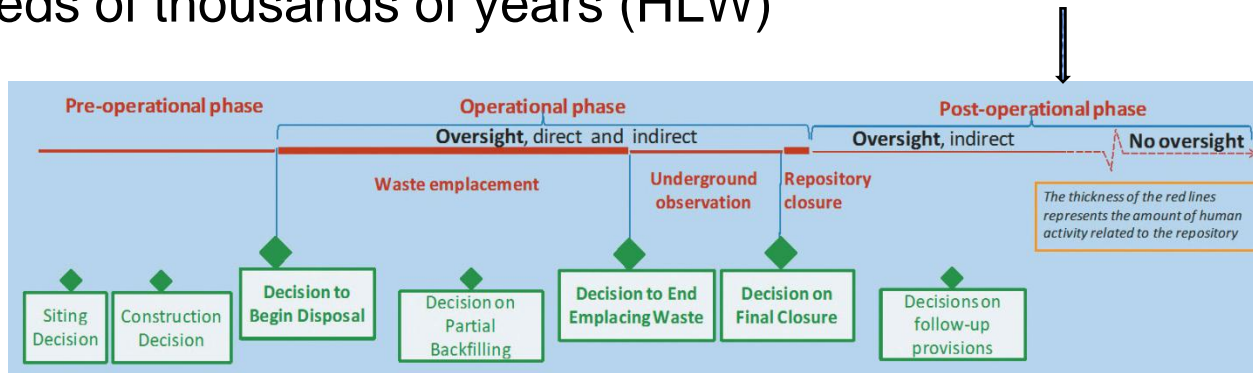
“Constructing memory”, Verdun, 17 September 2014

Anne Claudel, Section Head, Information Management, Nagra
on behalf of the RK&M project

nagra. 

Long-term and oversight: Glossary definitions

- **Long-term**: Period of time with **no repository oversight**, extending over the time of concern in the safety regulations, typically over hundreds of thousands of years (HLW)



- **Oversight**: general term for «watchful care», referring to society «keeping an eye» on the technical system and the actual implementation of plans and decisions.
 - regulatory supervision (such as control and inspection)
 - institutional control (e.g. monitoring)
 - preservation of societal records (such as archiving)
 - societal memory-keeping of the presence of the facility (importance increases as time goes by)

RK&M preservation in the long-term

- Lack of oversight = **lack of / decreasing memory-keeping** and awareness of the facility

Therefore:

Media and mechanisms still in place at the time of loss of oversight must **generate awareness** and draw attention to the facility

→ initiate a **new period of oversight**

- The facility is designed to contain and isolate the waste and be **safe by itself**

However, this “regeneration of awareness” is desirable, as oversight will reduce the probability of **inadvertent intrusion** and favour **taking informed decisions** about the facility

→ **no intention to forget!**

(but we must prepare for the time of lack of oversight)

As a reminder...

- RK&M Guiding Principle:

“There is no single best means of RK&M preservation over all time scales. All available communication channels should be envisaged”

Therefore:

We need a system whereby, within a strategy of **mediated** or **non-mediated** transmission of RK&M, the various elements are **linked** to each other, act as **indexes** to each other, and **reinforce** each other by offering redundant functions

→ **“systemic approach”**

Markers: A much-discussed topic

- «Marking a site»: often presented as the main method to **preserve memory and deter human intrusion**
 - Extensive **literature** exists (1990's / 2000's, mainly but not only US)
 - Recurring topic in the discussions surrounding geological disposal (and within the RK&M project)
 - Should markers be used at all?
 - When should we start preparing for them?
 - When should we construct them?
- Need for further evaluation and development of the corresponding **regulatory guidance**
- However: Use of markers foreseen only in Swiss legislation and US regulations

Markers: Glossary definition

- A marker is... «A **long-lasting object** that indicates an area of influence, power or danger, [...] placed strategically at or near the site (surface / subsurface) for immediate recognition or for discovery at a later time»
- Any marker is conceived to be
 - **immobile** (i.e., in permanent association with a site)
 - **robust**, in order to maximize survivability on its own
 - providing messages that are likely to be **understandable** across generations.
- A markers system can range from a simple stone to a contrived and monumental multi-component system

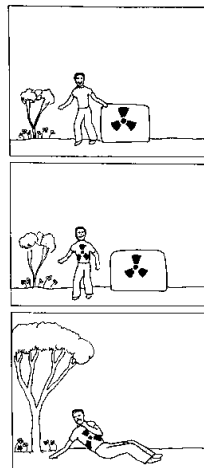
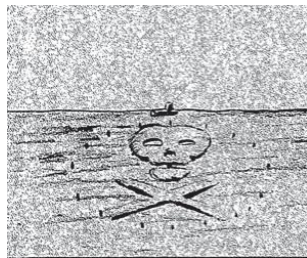
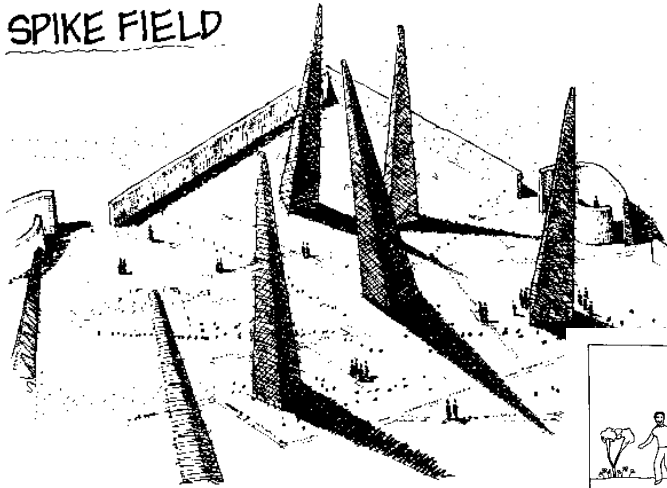


Markers and marking strategies

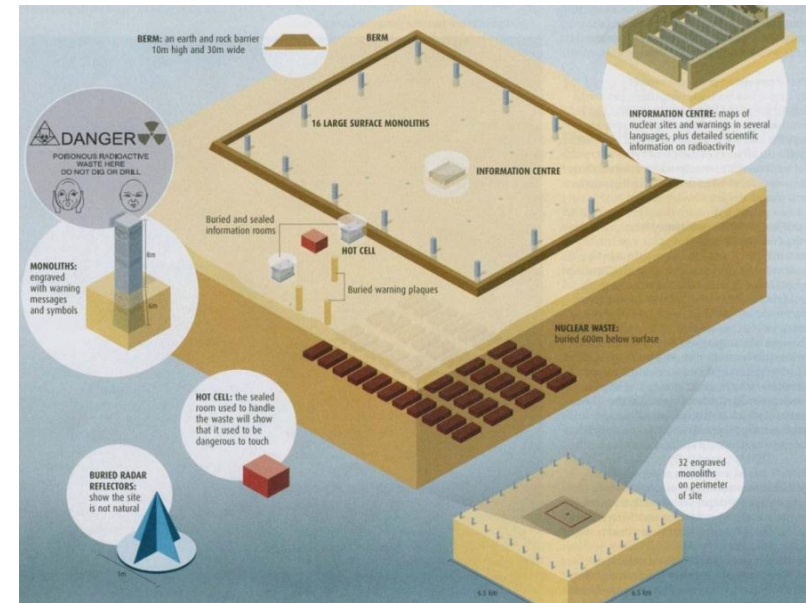
- «Literature Survey on Markers and Memory Preservation for Deep Geological Repositories»
(originally commissioned by the Swiss Federal Office of Energy)
- Many ideas, technologies, materials, such as:
 - **Surface** (e.g. large monuments, berms) and **subsurface** markers (e.g. small ceramic tokens)
 - Adaptation to the natural environment and / or use of non-recyclable and **non-reusable materials**
 - **Residual surface features** (e.g., retaining walls built to preserve visual amenity, altered water courses or access routes for road and rail)
 - «Self-marking»: message based on radioactivity or on other physical properties of disposal components, e.g. **gravitational magnetism**
 - «Cultural» marking through **site names**
 - New concept: «**time capsules**»

Some examples

SPIKE FIELD



DANGER
POISONOUS RADIOACTIVE  WASTE BURIED HERE
DO NOT DIG OR DRILL HERE BEFORE A.D. 12,000



However...

- There are, at present **no straightforward, conclusive answers** to the objectives, messages and methods of marking
 - Even if markers remain intact and traceable over time...
 - They can be **moved** or **destroyed**
 - Cultural and aesthetic interpretations or even deliberate falsification can **alter the meaning** of messages
 - They may **attract intruders** rather than deter them
- more specific studies on existing marking strategies are needed



Case study on tsunami stones

- «Markers – Reflections on Intergenerational Warnings in the Form of Japanese Tsunami Stones»
- Potential longevity and continuity demonstrated:
 - up to 1000 years / old stones replaced by new ones
- Historical and cultural significance may accrue over time, but original function may not be retained
- Messages **not always heeded**
 - Lack of awareness or understanding,
 - Reliance on other, more modern warning systems
 - Deferring responsibility to the authorities
 - Pursuit of short-term economic interests

→ Warning function more likely to survive in relatively **small rural communities** that have continuity, an oral history tradition, and a more limited access to, or confidence in, the latest technologies

Markers and beyond

- Factual information can be transferred more easily than warnings, memory more easily than knowledge
 - However: **Knowledge, not memory, saves lives**
- Strategy to foster learning / understanding and therefore knowledge
 - Leave traces to arouse curiosity and desire to learn more
 - Network of redundant markers placed strategically, acting as pointers to other sources of information
- Avenues for further enquiry
 - What **type** of markers should be emplaced?
 - What kind of **information/message** could they carry?
 - Where should they be **placed**? How should the network be **structured**?
 - What is the potential of **time capsules** within a marking system? What can we learn from other long-term endeavours (such as the “10,000 year clock” of the Long Now Foundation)?
- Effectiveness depends on the **care** exercised during previous periods

Conclusions

- There is **no single best means** of RK&M preservation – markers in isolation may not be fully effective
- We need to investigate the specific function of markers within a **systemic approach**
 - Markers in relation with **time periods**
 - Potential **interactions** with other RK&M preservation and transmission methods
 - Potential benefits of **international standardisation**

For more information...

<http://www.oecd-nea.org/rwm/rkm/>

**thank you
for your attention**

nagra.