

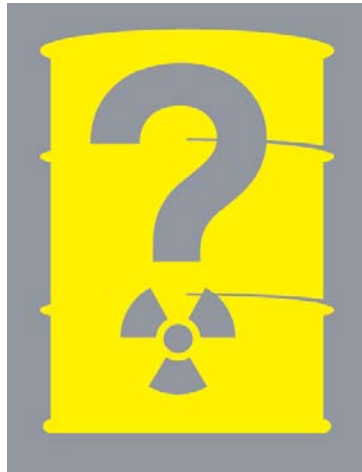
# Monitoring in the Swiss Concept of Deep Geological Repositories





# The story of an approach to solve an interdisciplinary problem

## Origins of the Swiss concept : Initial position



- Political stagnation
- Hardened fronts between active players (government, implementers...) and affected parties (cantons, environmental organisations...)
- Two disposal options with fundamentally differing characteristics

Reference :  
[www.energiestiftung.ch](http://www.energiestiftung.ch)

## Differing disposal options

- Permanent storage on the earth's surface



- Final disposal in deep geological formations



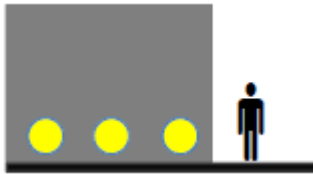
## Protection objectives of disposal



Reference : [www.coopzeitung.ch](http://www.coopzeitung.ch)

- The protection objectives of disposal were and are still uncontested
  - Safety  
to protect humans and the environment from harmful effects of the waste
  - Intergenerational justice  
to avoid undue burdens and obligations on future generations

## Differing disposal options : Freedom of action



- Permanent storage on the earth's surface
  - Grant future generations the freedom to decide for themselves



- Final disposal in deep geological formations
  - Relieve future generations from the burden of disposal

## Differing disposal options : Safety

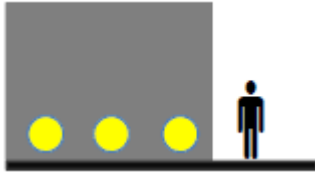


- Permanent storage on the earth's surface
  - Active safety, active control
  - Today's experts cannot be trusted
  - Today's knowledge is not sufficient
  - We should not miss the opportunities of the future

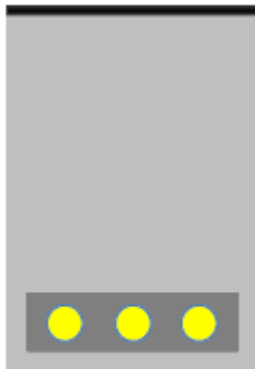


- Final disposal in deep geological formations
  - Passive safety
  - Today's experts are trustworthy
  - Today's knowledge is sufficient (to begin with activities directly related to the disposal)
  - We must counter the risks and uncertainties of the future

## Bridging the gap



- The solution to the political problem was finally found by a group of experts from engineering and earth sciences – and an ethicist



Reference : [www.nuclearwaste.info](http://www.nuclearwaste.info)



# Why was this group successful?

- some observations



Reference : [www.nuclearwaste.info](http://www.nuclearwaste.info)



Reference : [commons.wikimedia.org](https://commons.wikimedia.org)

- A matter of trust and specific constellations
  - A professionally recognised but unconventional chairman
  - A group of professionally recognised experts, perceived as unbiased and down-to-earth
  - The participation of an ethicist
  - The openness of the group to differing opinions

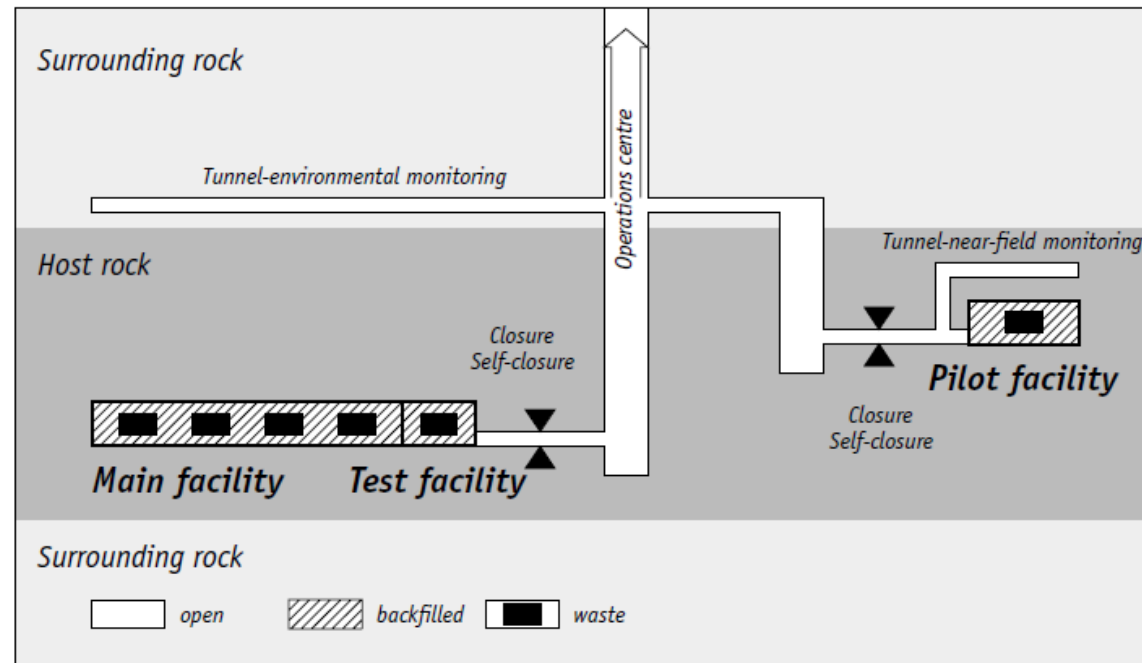
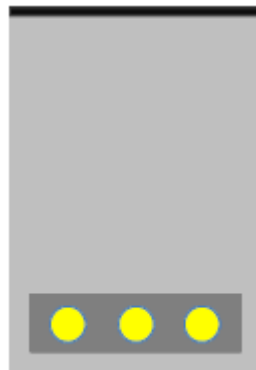
## What would a social scientist have added ?- some speculations



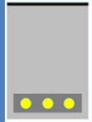
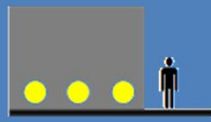
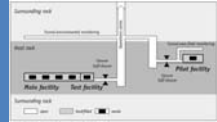
Reference : [www.awoberlin.de](http://www.awoberlin.de)

- Understand the differing notions of “safety” of different stakeholders
- Develop a good understanding for the need for “control”
- Develop a concept which encompasses organisational aspects, aspects of governance
- Question the circumstances under which the solution was developed

# Bridging the gap



## Bridging the gap

		
<ul style="list-style-type: none"> <li>• Passive safety</li> </ul>	<ul style="list-style-type: none"> <li>• Active safety, active control</li> </ul>	<ul style="list-style-type: none"> <li>• Passive safety in the main facility</li> <li>• Active safety and control in the pilot facility</li> </ul>
<ul style="list-style-type: none"> <li>• Experts trustworthy</li> <li>• Knowledge sufficient</li> </ul>	<ul style="list-style-type: none"> <li>• Experts not trustworthy</li> <li>• Knowledge not sufficient</li> </ul>	<ul style="list-style-type: none"> <li>• Pilot facility as a demonstration facility for the safety of the whole system</li> </ul>
<ul style="list-style-type: none"> <li>• Counter risks and uncertainties of the future</li> </ul>	<ul style="list-style-type: none"> <li>• Take advantage of future opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• Observation period without time limit after the emplacement of the waste</li> <li>• Retrievability</li> <li>• Quick closure of the whole facility in case of an emergency</li> </ul>

## Objectives of monitoring in the Swiss concept



Reference : [www.ensi.ch](http://www.ensi.ch)

- Concept of the expert group, which developed the concept (implicit)
  - “Control” of the nuclear waste
  - Confidence-building
  - Openness to better disposal solutions
  - Oriented towards societal demands
- Nuclear energy ordinance
  - Supervision of the development of waste, backfill material and host rock
  - Confirmation of long-term safety with a view to closure
  - Following technical reasoning

## Objectives of monitoring in the Swiss concept



Reference : [www.ensi.ch](http://www.ensi.ch)

- Recent revival of the societal aspects with additional ideas for the monitoring, e.g.
  - Investigating the relevance of new scientific insights for disposal
  - Maintaining competences in the field of nuclear safety and disposal
  - Differentiated decision-making support
  - Engaging the public in “generating safety”

## The “wicked problems” of the pilot facility



Reference : [www.nagra.ch](http://www.nagra.ch)

- “Control”
  - Representativity for the main facility
    - waste, canisters, backfilling, conditions in the host rock, hydrogeological conditions, heat distribution etc.
  - Accessibility impairs safety and security
  - Is “watching nothing to happen” a satisfactory understanding of control?

## The “wicked problems” of the pilot facility



Reference : [www.nagra.ch](http://www.nagra.ch)

- Trade-offs concerning safety
  - Monitoring makes it possible to detect unexpected developments at an early stage
  - Monitoring devices impair the safety and security of the disposal facility
  - Monitoring exposes persons to additional risks, e.g. when building the monitoring drifts or when making inspections
  - Uncertain gain in insight at the expense of certain risks for the staff and the public



## The “wicked problems” of the pilot facility



Reference : [www.nagra.ch](http://www.nagra.ch)

- Decision-making
  - Does the pilot plant furnish enough insights for important decisions?  
...like the decision to close the repository
  - How to act, if insights from the monitoring are not clear and unambiguous?

## Conclusions



Reference : [www.psi.ch](http://www.psi.ch)



Reference : [www.commons.wikimedia.org](http://www.commons.wikimedia.org)

- Monitoring is a societal as well as a technical challenge
- The monitoring of geological repositories must therefore be conceived as well from a societal as from a technical perspective
- For important milestones concerning the monitoring political decisions will be needed

## Conclusions



Reference : [www.psi.ch](http://www.psi.ch)



Reference : [www.commonswikimedia.org](http://www.commonswikimedia.org)

- With regard to safety, the advantages and disadvantages of monitoring have to be considered thoroughly
- Thereby, a broad range of aspects should be considered, like e.g. the maintenance of technical and scientific competencies
- These considerations should accompany the stepwise process by which disposal is realised

## Conclusions



Reference : [www.psi.ch](http://www.psi.ch)



Reference : [www.commons.wikimedia.org](http://www.commons.wikimedia.org)

- If monitoring is requested by society to control the waste, it's presumably not sufficient to just "watch what happens" but elements of active investigations are needed - for instance in rock laboratories
- If people, e.g. the local residents, want to participate in monitoring, appropriate opportunities should be considered

The story of an approach to solve  
an interdisciplinary problem  
– to be continued

Thank you for your attention

