Dutch radwaste policy: retrievability and staged decision

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A historical sketch

Policy concerning radwaste disposal is focused by

- **safety considerations**
- **societal developments**

Research into radwaste disposal

- **follows international developments (safety aspects)**
- **guided by policy development**

Public image of a radwaste disposal engineer

Waste
Isolation
Pilot
Plant

Disposal in a rock salt layer

Theoretician with blinkers on, with unchanging vision

Radwaste disposal is an integral part of the nuclear technology debate

Some historical background

Worldwide protests in the late 50s early 60s eventual led to

- 1963 Ban on nuclear weapon tests in the atmosphere
- 1968 Non Proliferation Treaty on nuclear weapon technology
- 1972 SALT treaty on limiting the number of nuclear war heads

Europe wide protests in the late 60s early 70s led to

- 1972 London “Dumping” Convention
  ban on sea dumping of HLW

Policy focused by safety and societal developments

Developments in the Netherlands

Following comparable developments in other European countries nuclear power generation was introduced in the Netherlands

- 1969 demonstration NPP Dodewaard connected to the grid
- 1973 commercial NPP Borssele connected to the grid
- 1974 plans for more commercial NPPs in the Netherlands

In the early 70s the Dutch Ministry of Economical Affairs initiated preliminary studies concerning the treatment of the radioactive waste generated by these NPPs

- 1974 RCN congress on disposal of nuclear waste concludes:

"It is technically feasible to treat nuclear fission waste in the Netherlands and dispose of it without detrimental effects on public health"

Policy focused by safety and societal developments

- 1975 Interdepartmental Commission on Nuclear Energy
  - LLW/MLW can either be dumped in the deep ocean or disposed of in large caverns in salt formations
  - Nuclear fission waste can be disposed of in a dedicated repository in salt formations (possibly after transmutation)

- 1975 Health Council advice
  - In principal, surface interim storage of nuclear waste is possible for an indefinite period of time
  - Research concerning the suitability of Dutch salt formations to host a repository for nuclear waste is needed

Policy focused by safety and societal developments

- 1976 Dutch Government starts National Programme

  A comprehensive research programme regarding the disposal of radwaste in rock salt, including exploratory drilling

  - 1976 – 1979 desk top studies conducted by RGD and RCN

<u>Why rock salt</u>?

- Easy mineability, good isolation properties (closure by creep)
- Rock salt is dry: no transport medium for dispersion
- Suitable salt domes in the northern provinces available
- Research in close collaboration with Germany possible

<u>Drawback</u>

- Because of the limited number of salt domes, opposition easily focused around these potential sites (nimby)

Policy focused by safety and societal developments

Experienced by the protests against the Vietnam war and – later on – the stationing of cruise missiles in the 70s, opposition against radwaste disposal in the northern provinces was well-organised

- 1979 Lansink's motion accepted in Parliament:
  - Before actual exploratory drilling would commence, the results of a 'Broad Public Debate' concerning the application of nuclear energy in the Netherlands should be available

- 1981 - 1983 'Broad Public Debate' ended inconclusive
  - The existing widely diverging opinions regarding nuclear energy could not be reconciled
  - Even the decisive themes remained unclear (safety, health, economy, risk future generations, etc.)
  - ➢ Advice to the government: no NPP new build

N.B. No conclusion regarding geological radwaste disposal

Policy focused by safety and societal developments

- 1984 Government Policy Note on Radioactive Waste

  Radiation protection:

  - Radiation exposure should remain as low as reasonably achievable (ALARA)
  - Expected radiation doses must remain below legal limits

  Radioactive Waste:

  - Waste management must satisfy the so-called IBC criteria (Dutch acronym for: isolation, control and monitoring)
  - No sea dumping of LLW/MLW
  - Founding of COVRA, the central organisation for radioactive waste management in the Netherlands
  - Start of the OPLA Programme concerning disposal in rock salt formations “on land”, consisting of 3 consecutive phases: (1) feasibility; (2) exploratory drilling; (3) underground research lab

Radwaste disposal research guided by policy development

- 1984 - 1988 OPLA phase 1 (mainly desk top studies)

  Safety study concerning disposal of radioactive waste in salt formations by means of available mining techniques

  - Conclusion:

    For all alternative concepts investigated, health risks remain below the imposed limits

  - Recommendation:
    probabilistic assessment to investigate the combined effects of uncertainties in the transport determining processes

Policy focused by safety and societal developments

- 1986 Chernobyl disaster
  - All plans for new build NPPs are put on ice
- 1989 Government decides intermediate phase (OPLA 1a)
  - Probabilistic assessment of a repository for radioactive waste in rock salt (dome and pillow), however ***no*** exploratory drilling (OPLA 2)
- 1989 Advisory Council for spatial, environmental and natural research on the disposal of non-processable waste:
  - Disposal of this waste should be definite
  - Leaving no burden to future generations
  - Retrievability of this waste should offer ‘free’ restoration in case that the safety of the disposal appears to be ill-assessed
  - Future generations must take responsibility regarding the ‘level’ of retrievability of the waste

Radwaste disposal research guided by policy development

- 1990 - 1993 OPLA phase 1a (desk top study)

  Probabilistic Safety Assessment (PROSA) concerning the disposal of radioactive waste in salt formations
  - State-of-the-art modelling applied
  - Application of a transparent and flexible methodology (PROSA) for scenario identification
  - ➢ Probabilistic assessment confirmed deterministic conclusions: For all scenarios the health risk remains less than 10^{-6}/a
  - ➢ Human intrusion scenarios bring about the largest risks

Policy focused by safety and societal developments

- 1990 Cabinet decision
  - Debate concerning the disposal of radioactive waste is extended to all non-processable waste

- 1993 Cabinet position paper concerning geological disposal in the light of ‘durable development’ (NMP action 62)
  - Minimising waste production
  - Recycling of non-avoidable waste
  - Incineration of non-recyclable waste for energy production
  - Retrievable disposal of the remaining waste satisfying the IBC criteria
  - ➢ Initiation of the CORA Programme:
    research into techniques for retrievable disposal of radwaste, both underground in different types of host rock and aboveground, including a comparison regarding safety and manageability

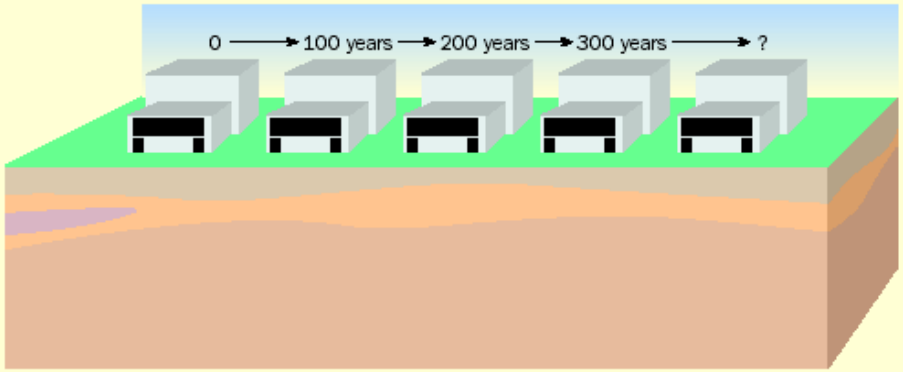
Radwaste disposal research guided by policy development

- 1993 - 2001 CORA Programme (mainly desk top studies)
  Development and comparison of retrievable disposal options

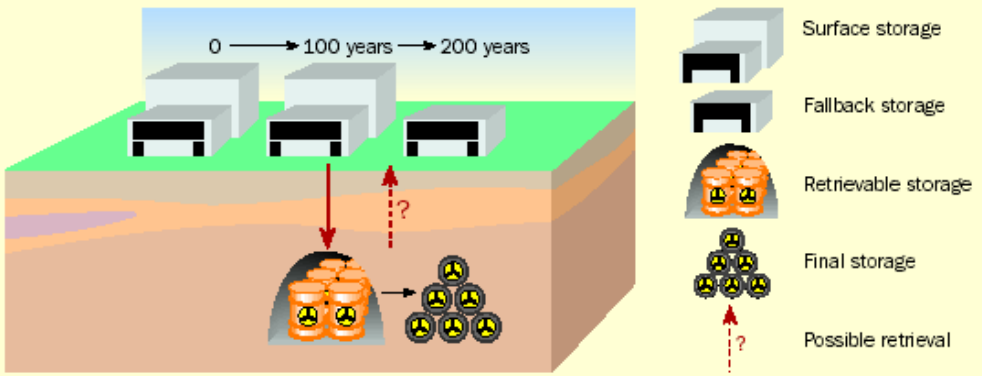
  <u>Conclusions</u>

  - No *technical* show stoppers for any of the options investigated
  - Aboveground disposal is to be preferred regarding retrievability, but clearly lacks a *natural* multi-barrier system and 'fail safe' guarantee
    - ➢ Eventually, geological disposal remains necessary
  - Retrievable disposal is feasible in both rock salt and Boom clay
    - ➢ Repository designs satisfying the retrievability requirement without compromising long-term safety properties developed
  - Disposal procedure: consecutive stages of aboveground interim storage and underground retrievable disposal ('staged decision')

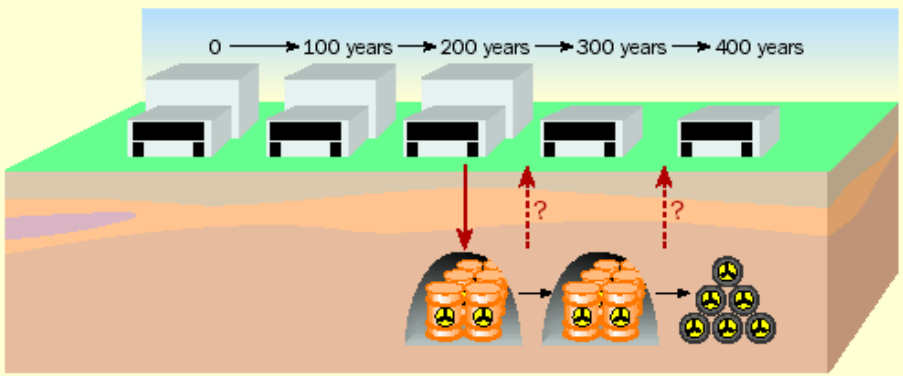
CORA report:
Storage variants with staged decision:
here every 100 years



Storage variant A — Long-term surface storage



Storage variant B — 100 years surface, 100 years retrievable underground, final closure



Storage variant C — 200 years surface, 200 years retrievable underground, final closure

Radwaste disposal research guided by policy development

- 1993 - 2001 CORA Programme (desk top studies)
  Development and comparison of retrievable disposal options

  Recommendations

  1. Technical aspects
  - Probabilistic assessment of the new developed repository designs
  - In-situ experiments in underground laboratories (host rock properties)
  - Development, manufacture and test of monitoring systems
  - Repository designs for combined HLW and MLW/LLW disposal
  - Further assessment of prolonged aboveground storage
  - Shallow land burial in bunker-like constructions for LLW/MLW
  - Verification of the radiation influences on rock salt

  2. Ethical and societal aspects
  - Relevant factors and stakeholders determining a public decision process
  - Check of different retrievable disposal options vs. societal criteria
  - Step-wise development of public decision process, without presumptions

Policy focused by safety and societal developments

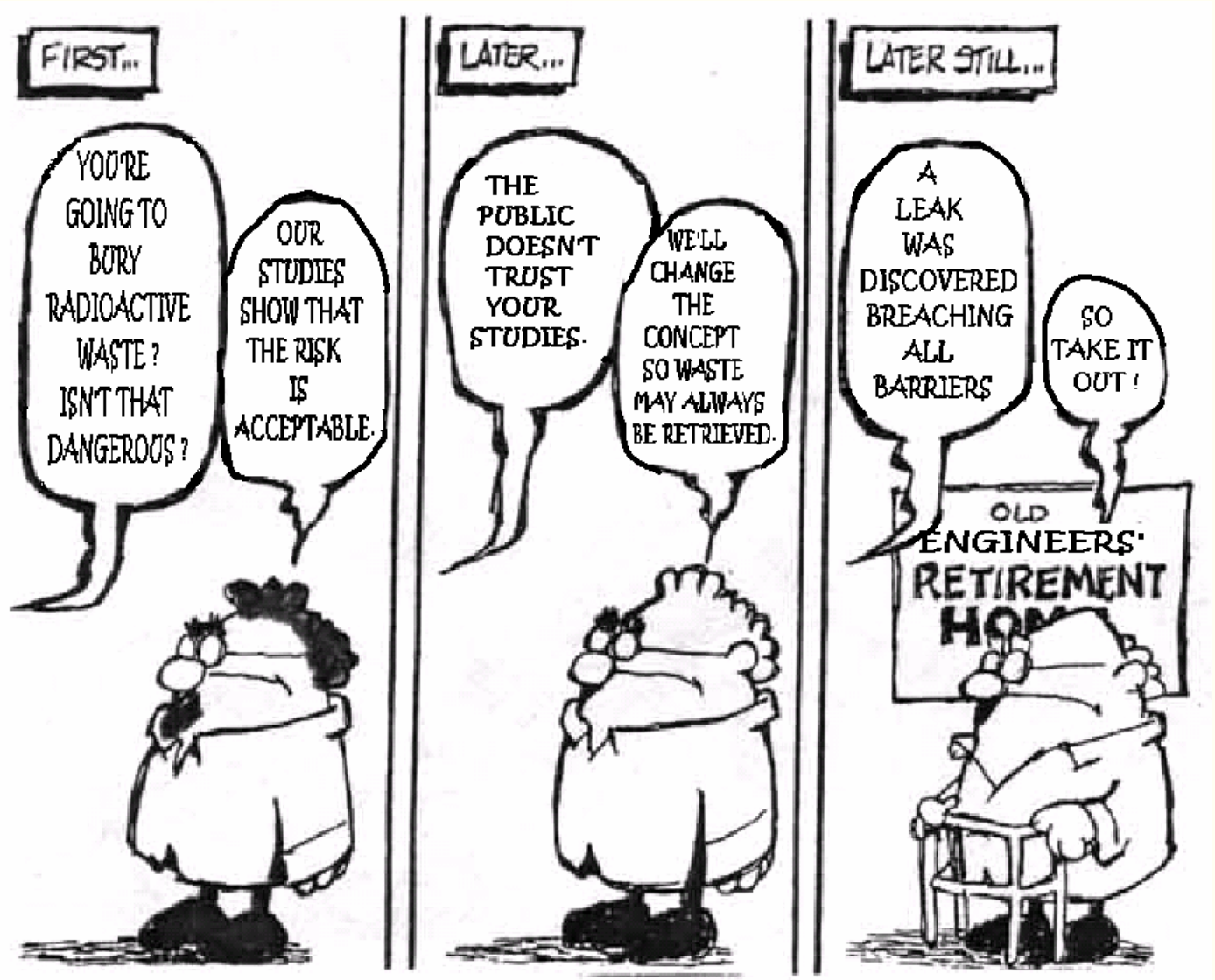
- 2002 VROM Policy statement - present status -
  1. COVRA is the sole company licensed to collect radioactive waste. The collected wastes are stored at the premises of COVRA (near the Borssele NPP).
  2. The waste remains in storage for at last 50 to 100 years.
  3. Meanwhile further research is conducted into the possibilities for deep geological disposal of the waste, preferable as part of EC Framework Programmes.
  4. Deep geological formations may only be used to dispose of high-level toxic wastes (including radioactive waste) if the waste remains retrievable, even on the long-term (NMP action 62).

Radwaste disposal research follows international developments

- Radwaste disposal research since 2002
  - Until now no successor programme was started
    - Dispute over funding (government or nuclear sector)
    - Lack of immediate necessity: a solution for 50 years is available
    - All political parties benefit by avoiding the nuclear issue
  - Instigated by one of the CORA recommendations:
    Collaboration agreement between NRG (NL) and SCK·CEN and EURIDICE (B) for in-situ investigation in the underground facility HADES concerning the repository relevant properties of Boom clay
  - Based on the VROM Policy statement:
    Participation in EC 6th Framework projects (partially VROM funded)
    - Laboratory tests and model development for rock properties
    - Development of the retrievability concept:
      * Staged operation of a repository: consecutive stages with decreasing level of retrievability
      * Notion of reversibility: ability to return to a stage with higher retrievability level

Self image of a radwaste disposal engineer

Waste disposal in rock salt or Boom clay



Looking for optimal acceptable solutions, but safety first

Policy concerning radwaste disposal is focused by

- **safety considerations**
- **societal developments**
- ➢ **retrievable disposal and staged decision**

Research into radwaste disposal

1. **follows international developments (safety aspects)**
2. **guided by policy development**

➢ **(1) continues – (2) awaits political / societal debate**

Thank you for your attention