



Data Management and Data Preservation in the Back-End

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Spent fuel data

- All data for the fuel must be available in the back-end
- Important to preserve fuel data, particularly for old fuels
- Different formats, paper etc.
- Databases
- What data is most important
- Different regulations: operational safety
- Long-term safety
- Safeguards of nuclear material
- Economical aspects; optimization
- Level of acceptable risks in the operations of the back-end with lack of fuel data

Spent fuel data rights to use and know

- Different ownership structures for the fuel, facilities, and different part of the nuclear cycle, and the back-end; state, private, different companies in different countries etc.
- Contracts for the fuel purchases: do they stipulate right to use and know the data in the back-end?
- If not – what is the legal situation?
- Right of fuel vendors for commercial secrets not to be disclosed to the back-end?
- Example: Swedish regulator SSM assumes complete right for SKB to know and use fuel data, but some fuel vendors do not necessarily accept this if there is no stipulation in contract
- How to deal with non-disclosure agreements (NDA's) – what if secrecy clauses are broken, could right to know and use data be denied?
- What if primary data about the fuel from the vendor is wrong – who would be responsible for potentially costly or dangerous events in the back-end?

Spent fuel data preservation

- The nuclear sector has now a history of around 80+ years
- Data exist in very different formats: paper, various electronic formats, various disc types etc., various languages
- Different forms of databases
- Old fuel data: when facilities shut-down important to preserve data
- Need of international harmonization of standards of best practice?

- (Final disposal: millions of years)

Back-end in Sweden

After leaving the reactor the fuel goes through the following steps in the Swedish back-end system:

At NPP

- Transport to fuel pools at NPP.
- In pools at the NPP, cooled for a few years

Transportation

- Dried for transportation in transport casks, maximum 24 h, normally around 12 h. Max temperature 400 deg C. *Calculations made to fulfill temperature requirement of 400 deg C, subcriticality, e.g.*
- Transport in dry transport casks, max temperature 400 deg C. Normally around 2 weeks, max Y months. *Calculations made to fulfill temperature requirement of 400 deg C, subcriticality, e.g.*

Back-end in Sweden cont.

Interim storage, Clab

- Transport cask off-loaded at Clab interim storage – from dry to wet
- Moved to service pools, then to storage pools – all wet; around 20-30 deg C.
- Storage pools, decades, 20-30 deg C. *Calculations made to fulfill decay power requirements at Clab, cooling system capacity, (temperature requirement of 400 deg C), subcriticality, e.g.*

Encapsulation, Clink

- Moved to dry hot cell in Clink.
- Dried at max X deg C. X not finally decided yet; will probably be between 125 and 250 deg C. depending on drying method
- Put into copper canister - dry. *Calculations made to fulfill temperature requirement of 12 deg. C on the Cu canister etc, subcriticality, e.g.*

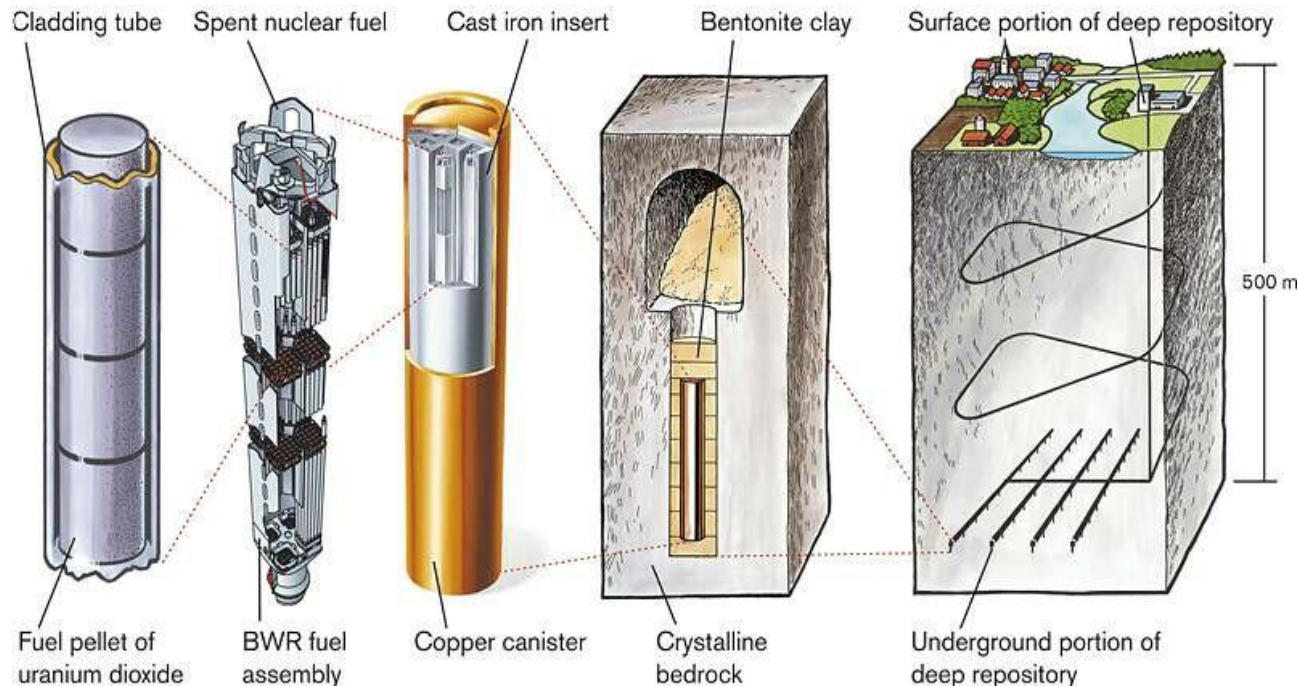
Back-end in Sweden cont.

Transportation to geological final repository

- Canister moved in transport cask to ship and then to geological repository.
Calculations made to fulfill temperature requirements, subcriticality, e.g.

Geological final repository

- Disposed of in the KBS-3 multibarrier system – ***eternity***. *Calculations made to fulfill temperature requirements of 100 deg C in the bentonite etc., subcriticality, nuclide inventory, radiation levels e.g.*



Examples of use of fuel data

- Decay power, temperatures etc.
- Criticality
- Radiation levels, doses, protection etc.
- Nuclide inventory for safety analyses
- Safeguards declaration and verification: identity, burn-up, fissile material, cooling time, initial enrichment, weight...
- Fuel integrity; damaged fuel, risk for failure when being handled...
- Weight and dimensions
- Design: possibility for trapped water e.g.

Databases at SKB

- SKB has two main fuel databases

PLUTO for operational data

DARK for safeguards data

- Development of new database for the long term, heading for the final repository
- Codes connected to the database

Importance of ‘mistakes’ and human errors

- Incorrect values in the records of the fuel elements exist - investigated systematically in Sweden now, but difficult to completely abolish
- Codes and scripts in various parts of the determination chain can contain errors
- Running of codes by different modelers often gives different result with the same code and the same input data
- Can be many decades between the different parts of the calculations in the back-end – facts may be forgotten, and understanding develops
- Etc.
- These are completely unsystematic and very difficult to analyze

Need for redundancies in the determination system that can flag anomalies – systematic measurements

Spent fuel data discussion points

- Legal rights of the back-end
- Right of fuel vendors for commercial secrets not to be disclosed to the back-end?
- Recommendations for purchase contracts?
- International standards of practice concerning organization of fuel data?
- Level of acceptable risks in the operations of the back-end with lack of fuel data
- How to deal with mistakes and errors