Inspection practice for NPP in decommissioning

Theo Neuffer
Ministry of the Environment, Climate Protection and the Energy Sector
Baden-Württemberg
Aspects I want to cover

• Experience with decommissioning license
• Involvement of regulatory body during decommissioning activities
• Evaluation of operator data
• Core areas of on-site inspection during decommissioning
• Upcoming challenges - 2019
Experience with decommissioning license

• Operation licence is still valid
• Decommissioning license equals an modification license
• It regulates certain areas e.g. emissions, overall decomm. activities, modifications (construction projects)
• License as „toolbox“, regulates mostly processes e.g. decommissioning process
• Only one license needed
• Building permit included e.g. for additional material hatch(es)
• Decommissioning with NSF inside reactor building
Involvement of regulatory body during decommissioning activities

Residual Systems

Operational Unit
- Operation of res. systems
- System downgrading
- System termination and separation

Decommissioning Unit
- System decommissioning
- Material logistics

Clearance
- new allowance process incl. on-site inspections

Waste treatment
- new facility, new operator

Storage for NHGW
- new facility, new operator

(reduced) routine on-site inspections

routine modification process incl. on-site inspections
New allowance process

- Measures to separate systems from residual systems
- Modification process with allowance by RB
- Assessment of dismantling activities in particular with regard to rad. protect., fire protect., labor protect., and measures to exclude interference with residual systems
- May contain recommendations and suggestions
- Contains all recommendations and suggestions taken into account by RB
- Allowance of dismantle activities
- RB performs regular on-site inspections of operator activities
Evaluation of operator data
Strategic decision

Dismantled Masses in metr. tons
- 2017: 494
- 2018: 1101
- 2019: 1727

Overall Activity in Bq
- 2017: 1.8E+18
- 2018: 4.0E+16
- 2019: 7.5E+13

- Removal of SNF
- Removal of core equipment
- Removal of resins
- Waste disposal emptied

~0.6% of total mass

Start of dismantling
Comparison of representative operator activities by man-hours
1 year after start of decomm.

Considerable less in-service and maintenance activities

- **Chemistry**
  - Plant in Power Operation: 5
  - Plant in Decommissioning: 1

- **Scaffolding**
  - Plant in Power Operation: 1
  - Plant in Decommissioning: 15

- **In-Service Inspections/Maintenance**
  - Plant in Power Operation: 15
  - Plant in Decommissioning: 5

- **Radiation Protection**
  - Plant in Power Operation: 30
  - Plant in Decommissioning: 25

in 1000 hours
Distribution of collective dose in decommissioning

- Overall collective dose: ~76 mSv
- Collective dose from decom. activity: ~61 mSv
- Decommissioning activities represent ~80% of collective dose of plant in decommissioning.
Comparison of doses in decommissioning and power operation

Average individual dose does not differ much between plant in power operation and decommissioning even though the overall activity on site is strongly reduced from 1E19 Bq to 1E13 Bq.

End of power op.  
Start Decommissioning.
Comparison of the dose distribution of the exposed personnel

Dose-ranges are comparable and do not differ much between plant in power operation and decommissioning.
Comparison of operator activity by doses

During power operation the major activities are performed on specific occasions during the year.

During decommissioning there are continuous activities during the year.

During Annual Outage the major activities are performed on specific occasions during the year.

Cask handling activities show a high dose level during specific months.

The graph shows the average individual dose [µSv] for each month from January to December 2017.

- **Decommissioning**
- **Power Operation**

The chart highlights the difference in dose levels between decommissioning and power operation activities throughout the year.
Operator activity oriented Inspections

During power operation
- Specific knowledge at the RB about activities
- Inspections plannable

During decommissioning
- General knowledge at the RB
- Inspections on short notice
- Unscheduled inspections become more relevant
Level of on-site inspections in comparison

Avg. 78 Man-days/a in Power Operation
Avg. 46 Man-days/a in decommissioning
→ Level of on-site inspections in decommissioning comes up to 60% compared to power operation

Support by TSO
• in power Operation: ~1773 in-service inspections per year and facility
• in decommissioning: ~323 in-service inspections per year and facility
→ Level of TSO technical checks decrease to ~20%
Level of on-site inspections in advanced state of decommissioning

监督管理密度在退役初期约为60%。
→ 降至约40%。

原因：
- 更少的安全相关系统
- 更少的在役服务检查/维修
- 更少的修改
- 更少的报告事件
- 其他功效核设施中更少的事件
Core areas of on-site inspection during decommissioning

- Inspection of residual systems (maintenance, in-service inspections)
- Inspect measures to protect residual systems
- Control if (relevant) dismantling sequences are obeyed
- Check of external staff/specialized suppliers activities
- Inspection of radiation protection- and fire protection measures, escape routes
- walk-downs with radiation protection unit of the operator
- Control of operator documentation
- Control of the clearance process
- Attend training sessions of the operator
Experience

- Licensing in one step is appropriate
- New process for approval of decommissioning activities in license
- Parallel supervision of residual systems and decommissioning activities
- During decommissioning there are permanent operator activities
- Regular on-site-inspections are needed in order to keep an overview over the plants status
- Inspections scheduled on short notice
- Risk to impair safety relevant systems decreases constantly
- Increase of decommissioning logistics
Challenges for Decommissioning - 2019

- Interim storage of dismantled components
- Commissioning and operation of waste treatment and storage facilities
- Adaption of infrastructure of reactor- and auxiliary building (material hatches)
- Decommissioning of primary components (SG, Pressurizer, MCP)
- Decontamination of buildings/compartments
- Establishing a process for clearance of structures/buildings
- Human resources: Change of operator staff/external suppliers
- Organizational changes after final shutdown of the last NPPs
- Handle the load of parallel authorization processes and multiple operators on site