Managing VLLW in German NPP Decommissioning Projects

An Overview and Insight from a Decommissioning Operator's Perspective

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23 January 2025



PreussenElektra GmbH - Our sites Pressurised water reactor, 1.480 MW Start of commercial operation: 1986 Shutdown: 2021 KBR - Brokdorf Start of dismantling: 2024 KKS - Stade Pressurised water reactor, 672 MW Pressurised water reactor, 1.410 MW Start of commercial operation: 1972 Start of commercial operation: 1979 KKU – Unterweser Shutdown: 2003 Shutdown: 2011 Start of dismantling: 2005 Start of dismantling: 2018 **Head Office – Hanover** Pressurised water reactor, 1.430 MW Start of commercial operation: 1985 KWG – Grohnde Boiling water reactor, 670 MW Shutdown: 2021 Start of commercial operation: 1971 KWW – Würgassen Start of dismantling: 2024 Shutdown: 1995 Start of dismantling: 1997 Pressurised water reactor, 1.345 MW Start of commercial operation: 1982 Shutdown: 2015 KKG – Grafenrheinfeld Start of dismantling: 2018 Pressurised water reactor, 1.485 MW Start of commercial operation: 1988 Shutdown: 2023 Boiling water reactor, 912 MW ___ KKI – Isar, Block 2 KKI – Isar, Block 1 Start of commercial operation: 1979 Start of dismantling: 2024 Shutdown: 2011 Start of dismantling: 2017 reussen

Managing VLLW in Germany - Webinar Technocentre Fessenheim

23.01.2025

Non-official translations

Waste Management in Germany

Legal Basis

Atomic Energy Act (AtG)

§ 2d AtG: Principle of Waste Minimization

"The **national waste management programme** [...] shall consider the following principles:

1. By means of an adequate design and operational and decommissioning procedures including the recycling of material, the accrual of radioactive waste shall be limited to what is reasonably feasible with respect to activity and volume. "

- Minimization of Radioactive Waste for Final Disposal
- → Application of Clearance mandatory

§ 2 EntsorgÜG: Hand-over of Responsibility for Disposal

The transfer of the disposal responsibility for a radioactive waste package to the federal government is only permissible if [...] the radioactive substances are not clearable in accordance with the legal provisions for clearance applicable at the time of the transfer.*

Waste Management Transfer Act (EntsorgÜG)

Radiation Protection Act (StrlSchV)

§§ 31 – 42 StrlSchV: Clearance

"The dose criterion for clearance shall be that only an effective dose in the range of 10 μ Sv per calendar year may occur to members of the public caused by the substances and articles to be cleared.

The competent authority shall issue clearance if the dose criterion for the clearance is complied with."*



Waste Management in Germany

Achieving Waste Minimization through Clearance

The Radiation Protection Ordinance (StrlSchV) provides a complex system for clearance:

- → Unrestricted (General) Clearance
- → Specific Clearance
 - Material for disposal at landfill
 - Material for incineration
 - Buildings for demolition or re-use
 - Metal scrap for recycling
- Clearance by case-by-case considerations

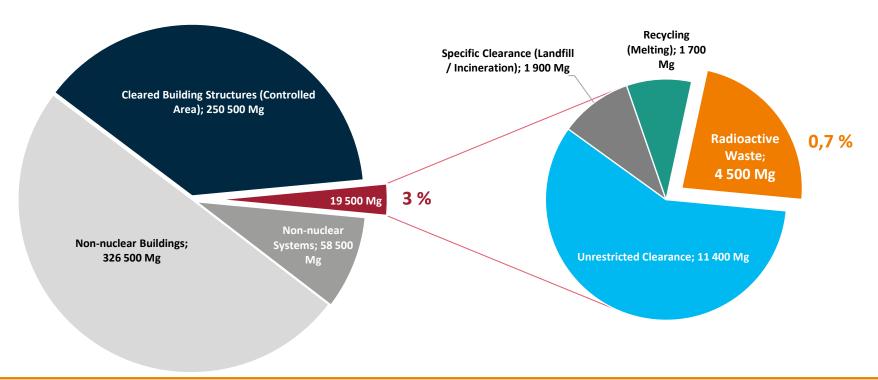
- → Basing on 10 μSv per year (De Minimis) Concept
- All processes to be approved by supervisory authorities
- Implementation in practice to be accompanied by authorities and independent experts



Implementation of Clearance during Decommissiong

Overview of Masses from Decommissioning of a Pressurized Water Reactor

Total Mass 655.000 Mg



→ More than 98 % of the masses of the nuclear area are non or very low radiactive and can be recovered and recycled or disposed of as conventional waste after decontamination and clearance



Technical Concepts for Waste Management

Waste Treatment Centers (WTC)

- → PEL's concept of WTC: On-site WTC at each NPP: integrated in existing buildings
- Facilities and treatment stations spread mainly over radiation-controlled area
- Available space depending on NPP design
- Alternative WTC concepts in Germany include on-site treatment in new buildings and centralized off-site treatment facilities
- External specialized facilities vital for effective waste management in Germany:
 e.g. Melting facilities for metal recycling



Waste Treatment Center in Turbine Hall of Würgassen NPP (Boiling Water Reactor)



Germany in the International Context

- Minimization of radioactive waste for disposal is nowadays incorporated in most national waste management programmes.
- These days, unrestricted clearance of materials is introduced in most countries and constitutes the main option beside radioactive waste.
- Recycling and reuse of material (specific clearance)
 - is supported by the international guidelines and recommendations e.g. RP 89, RP 122
 - is welcomed and strived by the nuclear industry
 - plays a minor role due to lack of accepting facilities or sufficient capacities
- German system for clearance is comprehensive and the most elaborated worldwide. It offers reliable criteria for setting up a
 waste management and clearance processes for all material from decommissioning.



Conclusions

- Decommissioning and clearance in Germany is indispensable and complex but feasible. An early planning and discussion of processes with competent authorities is key for an effective decommissioning and waste management.
- A complete documentation of all material streams from their origin and continuous tracking of its whereabouts is a key aspect in the German system and in particular for clearance.
- Experience transfer is essential for optimizing waste management at PEL's decommissioning projects; individual site-specific considerations required.
- No waste management without external treatment and disposal facilities and contractors: stable and reliable partners and processes enabling long-term planning and successful decommissioning.



Thank you!



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