

**Decommissioning of NPPs with spent
nuclear fuel present –
efforts to amend the German regulatory
framework to cope with this situation**

PREDEC 2016

Lyon, France, February 16-18, 2016

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Introduction

After the events at Japanese Nuclear Power Plant (NPP) Fukushima Daiichi in March 2011 the German government decided to

- “end the use of nuclear energy for the commercial generation of electricity at the earliest possible time – by gradually phasing it out.”

This decision resulted in an Amendment of the German Atomic Energy Act of July 31st, 2011

- withdrawing the authorisation to operate an installation for the fission of nuclear fuel for the commercial production of electricity for the seven oldest NPPs and NPP Krümmel on August 6th, 2011 and
- setting end-dates for the authorisation for the remaining 9 NPPs on a step-by-step-basis until 2022 at the latest.

Present Situation and Planned Activities

NPPs having applied for decommissioning

NPP	final shutdown	Application submitted	Location of fuel	Dismantling with fuel assemblies foreseen
Isar 1	06.08.2011	04.05.2012	cooling pond	yes
Unterweser	06.08.2011	04.05.2012 20.12.2013	cooling pond	yes
Biblis A	06.08.2011	06.08.2012	cooling pond	yes
Biblis B	06.08.2011	06.08.2012	cooling pond	yes
Brunsbüttel	06.08.2011	01.11.2012 19.12.2014	RPV (fuel assembly), cooling pond (defective fuel rods)	no (def. fuel rods)

Present Situation and Planned Activities

NPPs having applied for decommissioning (cont'd)

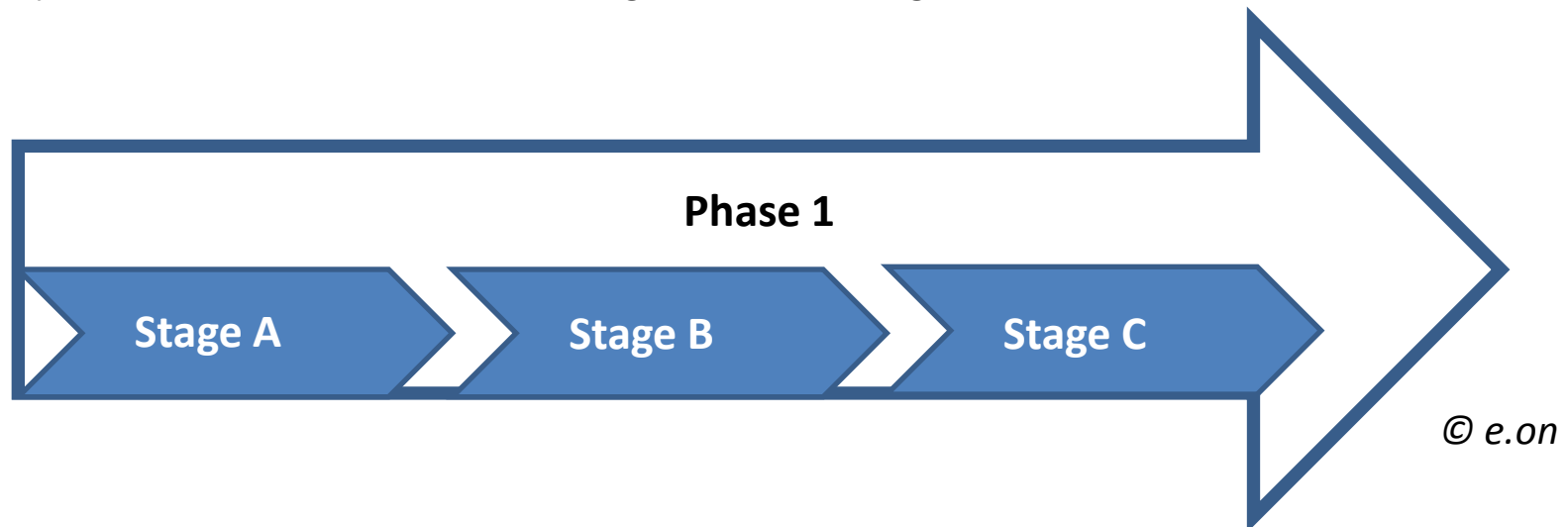
NPP	final shutdown	Application submitted	Location of fuel	Dismantling with fuel assemblies foreseen
Neckarwestheim 1	06.08.2011	24.04.2013	cooling pond	yes
Philippsburg 1	06.08.2011	24.04.2013 28.01.2014	cooling pond	yes
Krümmel	06.08.2011	24.08.2015	cooling pond	no (def. fuel rods)
Grafenrheinfeld	27.06.2015	28.03.2014	cooling pond	yes
Gundremmingen B	31.12.2017*	11.12.2014	cooling pond	yes

* As stipulated in § 7 (1a) German Atomic Energy Act

Planned Activities

Phased-approach for decommissioning is foreseen for the coming projects

- Typically phase 1 is divided into stages depending on presence of fuel, exemplary:



- Stage A: Fuel assemblies and defect fuel rods still present in cooling pond
- Stage B: Defect fuel rods still present
- Stage C: SNF-free NPP

Planned Activities

Typical activities foreseen in the first phase of decommissioning, exemplary:

- Dismantling of
 - Systems and components without safety-relevance for the residual operation
 - Reactor pressure vessel closure head and internals
 - Pipes inside the containment
- Construction of scaffolding for later dismantling works
- Creation of openings

Regulations Relevant for Decommissioning (excerpt)

- German Laws**
 - Atomic Energy Act (AtG)
 - Environmental Impact Assessment Act (UVPG)
 - Conventional Construction Act (BauGB)
- Ordinances**
 - Ordinance on Radiation Protection (StrlSchV)
 - Ordinance on the Nuclear Licensing Procedure (AtVfV)
 - Ordinance on the Nuclear Financial Security (AtDeckV)
- Sub-legal Level**
 - *BMUB Publications*
 - Decommissioning Guide
 - *Technical Rules*
 - *Advisory bodies' Recommendations*
 - Guideline for the Decommissioning of Nuclear Facilities

Decommissioning Guide

Objective of the Decommissioning Guide

- **Harmonize the procedures among all Länder authorities**
 - Comprehensive collection of existing requirements and recommendations on the decommissioning of nuclear facilities in Germany with a strong focus on procedural licensing and supervisory aspects
 - Contains among others
 - Aspects of decommissioning planning, licensing and supervision
 - Aspects to be considered during the safety assessment
 - Applicability of BMUB publications and KTA safety standards
- **Decommissioning Guide** represents good practice in Germany from regulatory point of view

Decommissioning Guide

Update of the Decommissioning Guide is in process

- Main aspects of clarification
 - Possible preparatory works during transition period
 - Unloading of fuel elements and removal of nuclear fuel as early as possible;
 - (Full) system decontamination
 - Taking material samples from systems and components for the purpose of a radiological characterization expected for the license application for decommissioning
 - Inventory-taking for hazardous substances (combustible, toxic, water-endangering etc.)

Decommissioning Guide

Update of the Decommissioning Guide is in process

- Main aspects of clarification (cont'd)
 - Possible preparatory works during transition period
 - Amendment of the operating rules
 - Utilization of residual radioactive material and removal of radioactive waste from the operating phase
 - Taking installations out of operation that are no longer needed for the current state of the facility and for decommissioning
 - Establishing areas for logistics (areas for buffer storage of residual radioactive material, transport routes)

Decommissioning Guide

Update of the Decommissioning Guide is in process

- Main aspects of clarification (cont'd)
 - Decommissioning with fuel elements still inside cooling ponds
 - Dismantling measures must not impermissibly impact safety relevant systems and components
 - Relevant categories of events
 - Reduced heat removal from the spent fuel pool
 - Loss of coolant from the spent fuel pool
 - Reactivity changes in the spent fuel pool
 - Events during handling and storage of fuel assemblies
 - Safety (re-)classification of SSCs

Decommissioning Guide

Update of the Decommissioning Guide is in process

- Main aspects of clarification (cont'd)
 - Applicability of BMUB publications, i. a.
 - Safety Requirements for Nuclear Power Plants
 - Guidelines Concerning the Proof of the Technical Qualification of Personnel
 - Applicability of KTA safety standards, i. a.
 - Requirements for the Emergency Manual
 - Integrated Management Systems for the Safe Operation of Nuclear Power Plants
 - Ageing Management in Nuclear Power Plants
 - Instrumentation and Reactor Protection
 - Energy and Media Supply

Guidelines for the Decommissioning of Nuclear Facilities

Objective of the Guidelines for the Decommissioning

- Technical guideline for members of the Nuclear Waste Management Commission (“Entsorgungskommission”, ESK)
 - ➔ **”working material” for ESK**, but of relevance also outside ESK
- Focus on technical safety related aspects
- Complementing the Decommissioning Guide in a technical sense

Update of the Guidelines for the Decommissioning just completed

- Published on March 16th, 2015

Guidelines for the Decommissioning of Nuclear Facilities

Contain recommendations on following aspects

- Decommissioning aspects during design and operation of a nuclear facility
- Technical measures in preparation of a decommissioning project
- Radiological characterization
- Plan for decommissioning (corresponds to IAEA concept of final decommissioning plan)
- Conduct of decommissioning
- Management of waste and residual material
- Safety assessment for decommissioning (as part of the licensing process)
- Operational instructions during decommissioning

Guidelines for the Decommissioning of Nuclear Facilities

Update focused on

- Presence of fuel during decommissioning:
 - Consider presence of fuel in the safety analysis for decommissioning
 - Safety Requirements for Nuclear Power Plants:
to be considered, if required from a safety technical point of view
- Requirements concerning decommissioning operating rules
- Dismantling activities
- Safety classification of systems and components

Conclusion

- No legal argument hindering decommissioning with fuel elements present, but removal of fuel elements as early as possible is beneficial for decommissioning
- Main aspect is that dismantling measures must not impermissibly impact safety relevant systems and components
- Key aspect: thorough (re-)classification of structures, systems and components

Thank you for your attention !