

Decommissioning in Germany: Greifswald NPPs

Bernd Rehs

Federal Office for Radiation Protection (BfS)

12th Meeting of the Working Party on Decommissioning and Dismantling (WPDD),
15th-17th November 2011, Paris

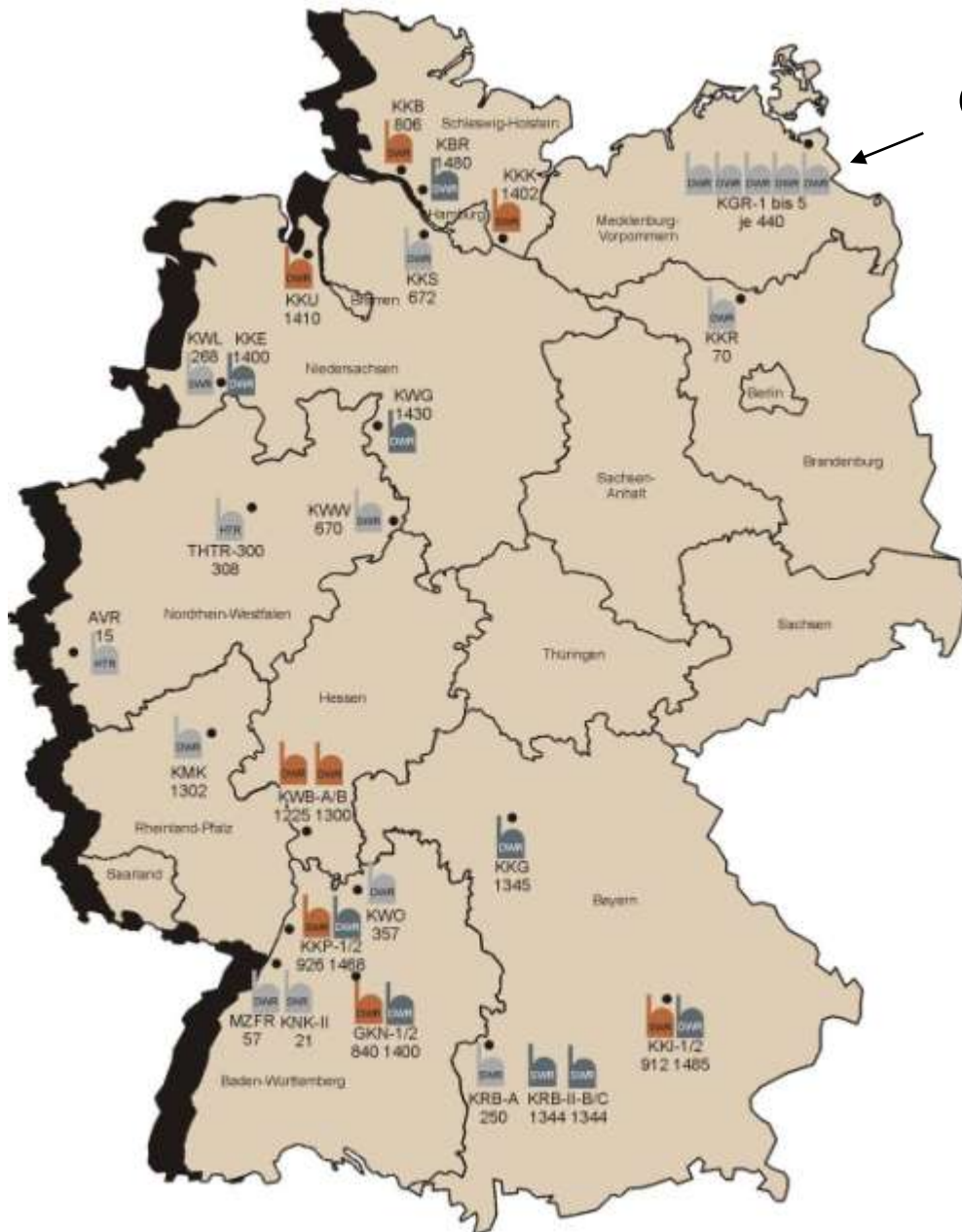


Overview: Status of Projects in Germany

	Power and Prototype Reactors	Research Reactors	Fuel Cycle Facilities
Operation	9	8	3
Permanent Shut Down	8	5	-
Decommissioning	16 <small>(thereof 2 in safe enclosure)</small>	5 <small>(thereof 2 in safe enclosure)</small>	4
Completely Dismantled	3	28	7




Status: August 2011

Nuclear power plants in Germany, Status August 2011



Greifswald NPPs



-  in operation
-  in final shutdown
-  in decommission

Map with Position Greifswald NPPs



Greifswald NPPs



NPP Greifswald, Units 1-5 (KGR)



NPPs
(units 1-5 operational,
units 6-8 under
construction)

Interim Storage
Facility North (ZLN)

- Operation: 1973 – 1990 (units 1-5 nuclear operational)
- Under decommissioning since 1995
- Total area: 170 ha

The role of Energiewerke Nord GmbH (EWN)

- The Energiewerke Nord GmbH (EWN) is decommissioning and dismantling i.a. the Greifswald Nuclear Power Plant (KGR) in the Land of Mecklenburg-Vorpommern.
- Besides the dismantling activities, the disposal and interim storage of the spent fuel elements and the resulting radioactive waste are main tasks of EWN.
- The only shareholder of the EWN is the Federal Ministry of Finance.
- Moreover, EWN is changing the former Greifswald NPP site into an important centre of energy and technology in Mecklenburg-Vorpommern.



**Turbine hall of
Greifswald NPPs**



**e.g. production of ship components
in the former turbine hall**



**Upgrade of infrastructure:
industrial harbour**

Basic Concept for Decommissioning and Dismantling

- Based on careful technical registration of all facilities, buildings and areas the procedure of decommissioning, dismantling and disposal was developed early.
- Non required systems are switched off at first, this means they are disconnected and separated from the operating systems, emptied (if necessary), cleaned and permanently isolated.
- Realize everything by own personnel and use commercial technical equipment as far as possible.
- The dismantling of the equipment is mainly executed room by room starting with the lower contaminated equipment, continuing with higher contaminated plant parts.
- Remove at first the so called "hot spots,, because of radiation protection for workers.
- Big dismantled components are taken to decay storage before cutting and further treatment.

Management of Large Components at Greifswald:



NPP at Greifswald



**Removal and
segmentation of a
steam generator**



Interim Storage North

Storage of:

- steam generators
- reactor vessels (KGR and KKR)



Dismantling Concept

- **Supervised area:** The dismantling is being realized manually by conventional methods and equipment. Special measures for the radiation protection of the personnel and the environment are only required in exceptional cases.
- **Controlled area:** All parts to be dismantled are supposed to be contaminated. The dismantling is carried out by commercial, manually operated and proved equipment under the usual supervision of the radiation protection. The dismantling of contaminated plant parts follows in principle room by room starting from areas with lower to those with higher contamination levels.
- **Activated Components:** The reactors with their main components were so highly activated by neutron radiation during the operation that a manual dismantling, as it is realized for other components, is impossible. Either these components have to be cut remotely and packed behind shieldings (concrete, steel or water) or they have to stay uncut and shielded in decay storage until the radiation will have decayed as far as it will be possible to cut the components under easier conditions (e.g. the reactor pressure vessels of units 1-5).

Storage of Nuclear Fuel

- When the Greifswald NPPs were shut down, there have been altogether 5037 used spent fuel elements in the wet fuel store (ZAB) and the nuclear power plant units 1-5. Additional there have been still 860 fresh fuel elements in Greifswald.
- Fresh fuel was sold to Czech Republic and USA; partialy spent fuel was sold to Hungary).
- As there is not any disposal facility for fuel in Germany there is only the opportunity to store the nuclear fuel in suitable containers in an interim store nearby the plant.
- For this fuel (and fuel from Rheinsberg NPP) the Interim Storage North (ISN) was constructed (also for other radioactive material).
- Reloading of fuel elements from the wet fuel store (ZAB) into the TLB CASTOR®440/84 in the refuelling unit of unit 3 started in 1999 (for decay storage in the ISN) and was finished in 2006.



Hall 8 of the transport cask store in the ISN with 65 CASTOR casks

Masses of Material and Waste

- The masses of material and waste at the Greifswald site which have to be disposed of amount to 1.800.000 tons from which about 1.236.000 tons are **not** contaminated with radioactivity. These masses are mostly building parts.
- Remaining masses have to be classified as radioactive residues and packaged in suitable containers for further treatment accordingly.
- Radioactive residues of about 564.000 tons contains about 67.000 tons of equipment to be dismantled, and 497.000 tons of contaminated building structures.
- A prerequisite for avoiding and reducing waste is to sort different kinds of material depending on its radioactive contamination during the preparation and execution of dismantling.



**Different kinds of residue packages
in the clearance measurement facility**

Storage Concept for Decommissioning Waste

- The main idea of the storage concept is to use the Interim Storage North (ISN) for the safekeeping of the existing nuclear fuel and for the interim and decay storage of radioactive residues and waste resulting from the decommissioning and dismantling.
- As a treatment station the ISN is equipped in a way that makes possible to treat almost all radioactive residues and waste, except nuclear fuel. With these facilities the conditioning and treatment of radioactive residues and waste can be separated from the dismantling activities.
- The Interim Storage North GmbH is a 100% per cent subsidiary company of the EWN GmbH. The ISN is being operated by the EWN GmbH.

ISN Caisson 4: Segmentation of a steam generator



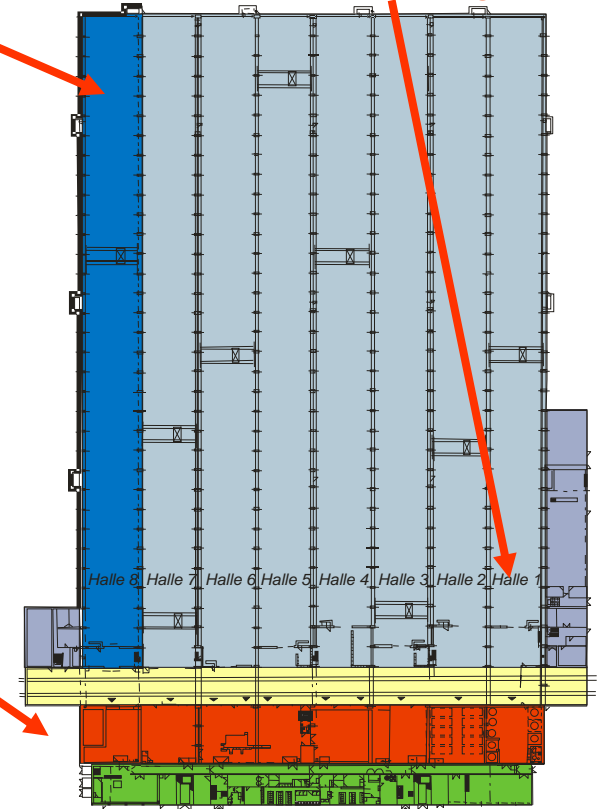
Interim Storage North (ISN)



Caissons for cutting, conditioning, evaporating

Storage facility for transport casks Hall 8

Federal state collecting depot



<u>Storage area</u>	20.000 m ²
<u>Dimensions</u>	240 m x 140 m x 18 m
<u>Halls 1-7</u>	Radioactive waste/residuals
<u>Hall 8</u>	Fuel elements in CASTOR-Casks
<u>Masses</u>	Halls 1-7 ca. 110.000 t Hall 8 585 t heavy metal

Tasks

- Interim storage facility for fuel elements
- Treatment of radioactive material
- Interim and decay storage of radioactive material

Clearance Procedure for Areas:

- Classification of areas (including legacies) with consideration of operational history (contaminated; suspicion of contamination; not contaminated)
- Mass- and area-related clearance levels for Co-60 and Cs-137 (unrestricted use) are fixed in notification. Further use of areas for industrial purposes is planned.
- Underground structures have to be evaluated and released; usually they are removed subsequently
- Infiltration of activity in soil must be excluded
- Recontamination after release must be excluded



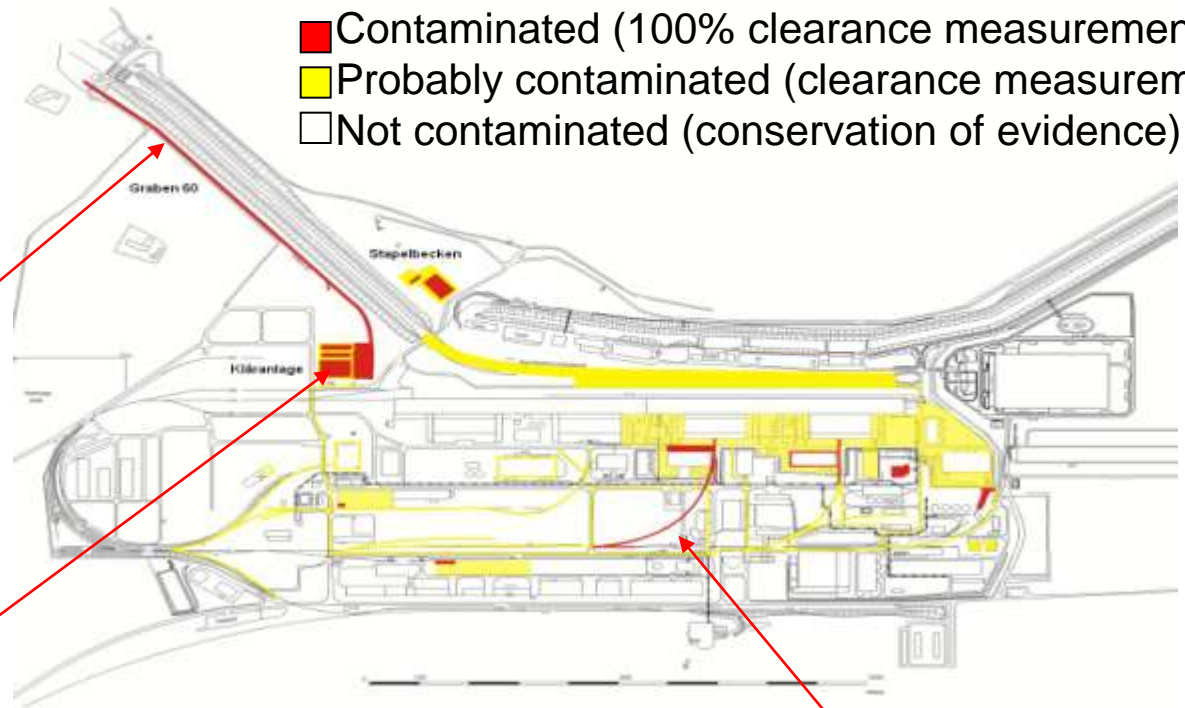
Drying bed of clarification plant was classified as contaminated (waste water canalisation).

Subsurface structures were evaluated and released, subsequently they were removed.



Bundesamt für Strahlenschutz

(Probably) Contaminated Areas KGR:



Example Release of Railtracks KGR:

Further use:

- In-situ gamma spectrometry

Complete removal:

- Removal of rails and crossties with subsequent clearance measurement or in-situ
- measurements for ballast are done seperately



Example Release of Trench 60:

1



Discharge of radioactive substances during operation caused contamination

2



After removal of concrete slabs and cleaning

3



Pilot survey by in-situ measurements

4



Surface abrasion by raster scan, subsequent clearance measurement

Actual Status Decommissioning and Dismantling Greifswald NPPs

- Licensing Procedure for dismantling of plant components is nearly finished
- About 75% of plant components in controlled area are dismantled
- About 95% of plant components in supervised area are dismantled
- Decommissioning works will be finished presumably in 2012
- **Objective:** Complete dismantling of main components and removal of radioactive legacy (remediation of area). No complete demolition of buildings planned, subsequent industrial use.

Thank You for Your Attention !