

EWN - The Greifswald Nuclear Power Plant Site

Energiewerke Nord GmbH

Waste management & Interim Storage North (ISN)

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1. Waste management

Obviously, prevailing laws and regulations (*Atomic Law, Radiological Protection Ordinance etc ...*) must be strictly followed.

The disposal of the fuel and operational waste is a precondition for the decommissioning and the subsequent dismantling. In order to be able to handle and treat the enormous mass flow, it is necessary to plan and install the waste management facilities at an early project state.

The waste management concept is mainly based on the following frame conditions and principles:

- Removal of the spent fuel from the reactors and cooling ponds and their storage in the wet interim storage and later transport in dry CASTOR casks to the Interim Storage North.
- Provision of sufficient buffer and intermediate storage capacities to achieve a high flexibility in the logistics and waste management.

Therefore, the construction of the Interim Storage North for the storage of nuclear fuel and radioactive waste and treatment and conditioning of dismantled material is of essential importance.

- Installation of equipment for the treatment of dismantled material using modern technologies for the reduction of dose exposure and increase of efficiency.
 - To use the limited final storage capacity of the ERAM until 2000 as far as possible.
 - Further use of the existing waste facilities, upgrading or extension, as far as it is economically justified.
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2. Decommissioning waste

2.1. Inventory

For the planning it was absolutely necessary to record the actual state.

This particularly includes the registration of masses and materials, dose exposure rates in the plant rooms and of the components as well as the preparation of a contamination catalogue.

In total, 1 800 000 Mg of material will be produced during the decommissioning of the Greifswald plant. The definitively non-radioactive and restrictive masses can be treated as conventional residues and utilized or removed according to the valid waste regulations.

The remaining 570 000 Mg have to be classified as radioactive residuals or possibly contaminated material and must be treated accordingly.

The resulting material flow in this dimension is unique and is tremendously difficult to manage it logistically. Fig. 1 shows an overview of the mass and activity flow during the decommissioning and their prospective classification to the disposal objectives.

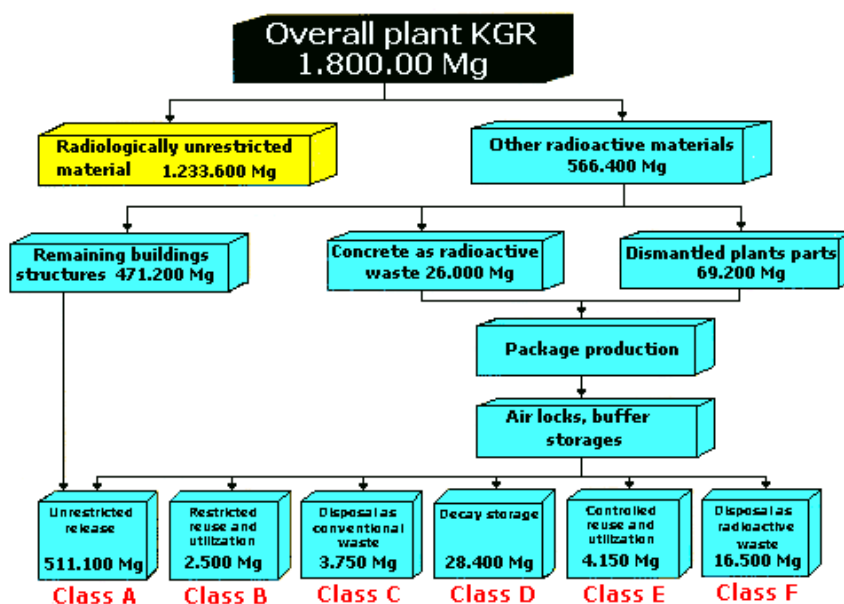


Figure 1. Mass flow at Greifswald

The activity inventory of the Greifswald site in 1990 excluding spent fuel was approximately $3.5 \cdot 10^{17}$ Bq. The share of activated components is 99 %.

The remaining percentage includes the operational waste, contaminated plant parts, and the building structures of the controlled areas.

2.2. Disposal objectives

The timely definition of the disposal objectives under inclusion of the collection and sorting of the produced masses and their classification makes it possible to proceed systematically and to reduce the amount of radioactive waste.

It is distinguished between the following classes:

- Class A: Free release;
- Class B: Reuse;
- Class C: Disposal as conventional waste;
- Class D: Decay storage;
- Class E: Reuse in nuclear facilities;
- Class F: Disposal as radioactive waste.

The limit values for the classes A, B and C, are an integral part of the license for decommissioning from 30 June 1995.

3. Concept of "ISN"

The Waste Management Concept of the Energiewerke Nord GmbH foresees a direct and complete dismantling of the 6 switched-off reactor units within the next 15 years.

A central task in this Waste Management Concept is the construction and use of the "Interim Storage North (ISN)" for the storage of the spent nuclear fuel and for interim and decay storage of the radioactive material produced during the decommissioning and dismantling. The Energiewerke Nord GmbH is the owner and operator of this storage.

With the facilities of the ISN, the treatment of the radioactive residues can be physically and timely separated from the dismantling works.

By the interim and buffer storage of the raw waste and waste packages, a high flexibility in logistics and waste management strategy can be achieved.

Fig. 2 shows a sight view of the ISN.



Figure 2. Sight view of the Interim Storage North (ISN)

4. Site, overall arrangement and design of the plant

The site of the ISN is located in the immediate vicinity of the Greifswald Nuclear Power Plant. A general view of the ISN site, areas and infrastructure is shown in Fig. 3.

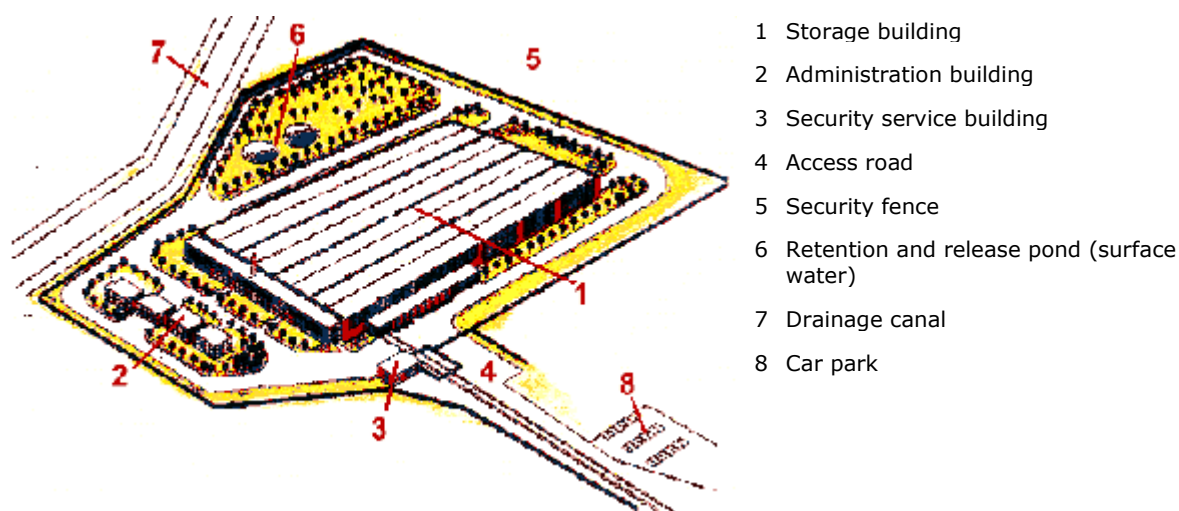


Figure 3. General view of the ISN site

The cross section of the storage building is shown below (Fig. 4); the dimensions of this building are:

- length: 240 m;
- width: 140 m;
- building height: 18 m.

To guarantee an annular ambient dose rate maximum of 0.3 mSv at the site boarder, the building has a 70 to 100 cm outer concrete cover.

The building is composed of:

- storage area;
- loading area;
- conditioning area;
- operational and social building;
- northern extension;
- southern extension.

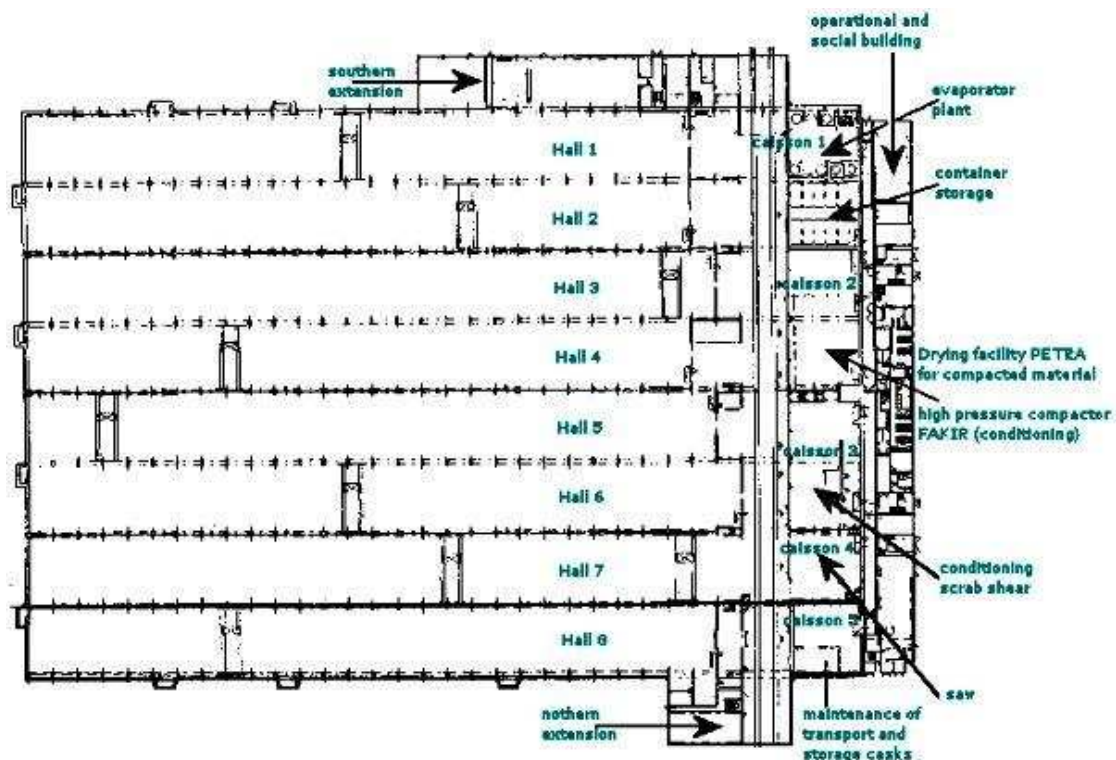


Figure 4. Cross section of the storage building

Area/Storage volume	
Halls 1-7	17 500 m ² /200 000 m ³
Hall 8	2 500 m ²
Activity	
Halls 1-7	4.5 x 10 ¹⁷ Bq
Hall 8	7.5 x 10 ¹⁸ Bq
Containers	
Halls 1-7	<ul style="list-style-type: none"> • 20'-containers • cast iron containers • concrete containers • steel containers • casks (cast iron) • large components
Hall 8	CASTOR casks of type <ul style="list-style-type: none"> • 440 / 84 • 440 / 84 mvK • KRB / MOX
Masses	
Halls 1-7	approximately 110 000 Mg
Hall 8	585 Mg (heavy metal)

Table 1: Main data of the storage building "ISN"

The storage area comprises a usable total area of about 20 000 m², and the usable height is approximately 10 m.

For storage, 8 halls are available, which are connected at the front end by a loading hall.

The halls 1 to 5 can accommodate all kinds of waste packages and be used for intermediate storage of untreated residues.

The halls 6 and 7 are foreseen for the storage of large components and hall 8 for nuclear fuel in CASTOR casks.

All halls are equipped with bridge cranes. The crane capacity of the halls 1 to 5 is 320 kN each, halls 6 and 8, 1 400 kN each, and hall 7 about 2 times 1 400 kN.

The cranes can be moved along the whole halls to the loading area up to the caissons in the conditioning area.

The main data of the storage building are summarized in Table 1.

Adjacent to the loading hall, the conditioning area is located. This area is about 2 450 m². The conditioning area consists of:

- caissons 1 to 4 for conditioning of solid and liquid radioactive waste and residues;
- container storage for containers with raw waste to be treated;
- caisson 5 for the maintenance of transport and storage casks.

5. Storage strategy

To dismantle the five units in Greifswald fast and economically, the large components of the primary circuits will be transported to the ISN as a whole or in as large as possible parts. There, after decay storage, they will be cut and packed for final storage.

This strategy will also be applied for the activated reactor pressure vessels and their internals. Reasons for this are:

- minimization of the collective dose of the dismantling personnel in the power plant units;
- minimization of the cask and container costs by making use of the decay behaviour of radioactive materials.

To meet the required storage conditions, it is necessary to limit the ambient dose rate of the storage containers or large components to 0.1 mSv/h in 2 m distance.

This will be achieved by secondary shielding. These containers and components will only be transported on non-public traffic ways.

Instead of the originally foreseen cast iron casks type II and concrete containers type IV with a weight limit of 20 Mg (due to the present acceptance criteria in the Konrad final storage), now, also concrete and cast iron containers type VII are foreseen to be used.

These will be loaded with the pre-cut activated components from the units 1 to 4. The activated components from unit 5 shall not be cut in the power plant but stored as large components. After a corresponding decay time, cutting will be possible in the conditioning area of the ISN.

The fuel elements in hall 8 will mainly be stored in CASTOR casks of type 440 / 84. There, 80 storage places are available: 64 storage places will be needed for the 5 048 fuel elements from Greifswald and Rheinsberg. The remaining places will serve as a reserve and for the storage of e.g. core internals and sources in CASTOR casks.

6. Summary

On 20 February 1998, the *"License according to § 3 of the Radiation Protection Ordinance for the conditioning and interim storage of radioactive residues / wastes in the Interim Storage North (ISN), Rubenow"* was issued.

In 1992, the application for the construction of the storage building and for the handling of radioactive materials according to *"§ 3 of the Radiation Protection Ordinance"* was filed.

Thus, within only 6 years, an ultramodern waste storage and treatment centre has been established.

The license for the storage of the CASTOR casks in hall 8 is expected to be issued in the second half of 1998. The Interim Storage North (ISN) allows an independent and autarkic treatment and storage of the radioactive material flow from the dismantling projects of the Greifswald and Rheinsberg Nuclear Power Plants and also offers attractive services for third parties.

Together with the hot workshop on the Greifswald site and the free classing facility, supported by an integral electronic data processing mass flow control system, the ISN meets in all matters the requirements for modern waste management.