

ACTUAL SITUATION AND FURTHER DEVELOPMENT OF INTERIM STORAGE OF SPENT NUCLEAR FUEL (SNF) AND HIGHLY ACTIVE WASTE (HAW) FROM THE VIEW OF THE COMPETENT AUTHORITY IN THE FIELD OF §6

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Abstract

According to the German atomic law the storage of nuclear material has to be licensed following § 6 by the competent authority in this field, which is the Federal Office for Radiation Protection.

Interim storage in its actual form started in 2002 in the interim storage facility next to the NPP Lingen.

Since this time each NPP erected its own storage facilities and three central storage facilities have been built. The spent nuclear fuel (SNF) and the vitrified high level waste (HAW) will be stored there until final disposal. The time span from now on to the point of opening of a final disposal facility shall be presented from a regulators point of view, divided into different phase which could spread from years to decades. Special attention shall be drawn on the different aspects influencing the licensing process and its duration at the moment and in future including the capabilities of the competent authority.

1. Introduction

The Federal Office for Radiation Protection foresees three different stages in the timescale of interim storage. In the current first one, modifications of existing storage licenses and one interim storage left to be licensed and erected are in the licensing procedure according to § 6 atomic law. This includes also applications for new casks. Following those licenses a phase of applications will arise to take care of remaining exotic inventory like damaged fuel elements, high or low burnup elements etc. These are especially important as the major part of demolishing of shutdown NPPs can only start when all nuclear fuel is safely stored outside the NPPs.

The next stage will begin after the shutdown of the nuclear power plants (NPPs) wherein the storage sites have to be independent of a neighbouring plant including its infrastructure in terms of safety and security. The process of reaching this autarky has to be reached and maintained until the final disposal site is starting its operation. During this period changes in regulatory framework and technological progress may influence existing licenses.

The third stage is entered when the currently granted licenses will expire and a final disposal facility isn't in operation yet. This means there will be an urgent need for extended interim storage. Important inputs for this task are the findings of the periodic safety examination (PSÜ). Reaching the final stage of

conditioning, repackaging and transport to a final disposal facility will be strongly connected to the decision in which way the disposal will be done.

2. Developments in National and European Regulations

2.1 National developments

As long as § 6 atomic law licenses are granted to cover all the different casks and inventory, the technological progress is continuously transferred into the safety concept of interim storage. This is notable in the frequent changes of the atomic law, the developments in the environment protecting law, progress in the rules for radiation protection and renewal of specified technological rules eg KTA (earthquakes, crane) and last but not least the last version of the “Leitlinie für die trockene Zwischenlagerung” which has been modified to address and include the newest technological and scientific knowledge. In the stage of ongoing storage without any new licenses needed, it might be necessary to include new technological development in existing licenses to cover future findings. Latest at the renewal or prolonging of existing storage facilities and the connected licenses, the new base of knowledge has to be considered.

2.2 European developments

As progress is made in the European Union towards the harmonisation of national laws, this is likely to occur in the field of nuclear waste disposal as well. First examples are already under discussion and national law is changing.

At this point we will have to accept different safety assessments in different countries. This is for instance notable in the different cask design found in different member states (two lids or one), as well as in different concepts for handling low level waste or the requirements for the storage building itself. Also the question whether or how the licensing of interim storage facilities is to be bound on limited time or not will be a probable topic. There might soon be also a discussion about the question how member states without any suitable host rock for final disposal are going to handle this and under which circumstances export of such material could be allowed.

3. Timeframes and their distinct challenges

As depicted in the introduction, the actual and viable future situation for the interim storage in Germany is showing several distinct timeframes with their own challenges. After the present timeframe with the licensing of cask types and modifications for different types of inventory, the next stage will be the autarky of the interim storage facilities after the shutdown of the NPPs. As the search, preparation and operation of a final disposal site is probable to exceed the primary set licensing time of 40 years for the interim storage facilities, it will be necessary to renew or extend the lifetime of the current facilities. Finally the preparation for the final disposal has to be ensured.

3.1 Interim storage after ending of the NPP service

The actual storage concept in Germany for spent nuclear fuel (SNF) and high active radioactive waste (HAW) is based on the dry interim storage in metallic casks. Changes in this concept might happen in future times by public interest and/or local authorities. This could be initiated by changes in the local surrounding of the storage site as well as changes in the organisation structure of the former NPP owner. Another driving force for conceptual changes might be the question if a centralization of all storage sites after demolition of all NPPs is viewable in order to make common use of special infrastructure like the pilot conditioning plant in Gorleben. This would although require a common understanding about the necessity or beneficial aspects of such centralization, especially in the public opinion. Connected to this issue is the fact that the autarky of the storage facilities has to be secured after the NPPs cease their

operation. Furthermore the concept of storage might be changed by happenings in the security field closely connected to technological progress.

3.2 Extension of licenses after the first 40 years of storage

After forty years of dry interim storage the current licenses will expire. An extension or a new license can only be granted if the requirements are met at this time. This requires detailed knowledge about the happenings and accidents during the past. All experience of the periodic safety assessment (PSÜ) and accompanying experiments will be needed. Major aspect is of course the protection against radiation and radioactive release. This is mainly provided by the cask with its body and lid system. This includes devices like manometric switch and self-sealing-coupling. To guarantee the function for times over the already determined forty years a careful determination of bolts and gaskets used to seal the flask as well as an examination of possible corrosion effects from out- or inside the body, degradation of used moderator- and or absorber elements by radiation and or thermal loadings, internal cladding or other surface protecting layers is necessary. Also the handling devices like trunnions and their connecting screws have to prove mechanical stability.

Inside the flask the basket design has to allow removal of the inventory and the fuel elements need to stay in a shape which allows handling. Effects like gas evolution or hydrogen embrittlement have to be examined.

Beside the cask, the site and the storage building itself with its technical installations have to be reviewed. This includes the inspections of the building and ensuring of maintenance and repairs, as well as the probably exchange of technical machinery if necessary. Connected to this is also the documentation of the stored inventory with the probably changing storage system for this data. The surroundings of the storage site are also to be taken into account. Due to the demolition of the NPPs, the usage as an exclusively industrial area might have ceased. Due to public interest the surroundings might be wanted as space for new buildings. Also possible changes in air traffic, like newly established flight routes and the change in size of used airplanes have to be addressed.

After demolition of the NPP the groundwater level could be affected which may lead to consequences for the storage building.

Finally the question if there will be another fixed license period is given or a license “until final disposal site is available” has to be addressed, especially taking public and political interests into account.

3.3 Preparations for final disposal

In our understanding the time during the interim storage should be used to gain knowledge and to decide about the way and location of final disposal. If already decided or at least depicted, the decisions for a disposal site or at least host rock should influence the licensing of the interim storage facilities, so that the needs for the final disposal can be met beforehand. Especially the sort of host rock has a great influence on the casks suitable for the final disposal. Therefore it might become necessary to reload of all currently stored casks. This is of course a major aspect in the question if a centralized interim storage is to be preferred or not. Installing reloading facilities on each storage facility site is obviously a suboptimal choice, especially if the surroundings of the storage facility have changed as depicted in 3.2. On the other hand, securing the usage of the present storage casks for the final disposal might not be viewable as it might constrain the parameters for the search for the final disposal site. Therefore, following the discussion process and the changes in technology and science connected to final disposal is a necessity for the competent authority to ensure a proper licensing for the interim storage facilities and the smooth transition into the final disposal regime when ready.

4. Situation of the § 6 atomic law competent authority itself

The competent authority in the field of § 6 atomic law has to consider the above mentioned challenges and ensure the necessary resources. This includes not only the actual the personal and logistic necessities to deal with the licences applied for but also the specific needs occurring due to the future developments. Even after the successful decommissioning and demolition of all NPPs in Germany the need for extension licenses will require a competent authority which has the knowledge acquired during the last decades. This is an especially important aspect as the knowledge management for the decades to come has to be ensured beforehand. Given the long timeframe the preservation of an appropriate amount of competent staff as well as the connected knowledge transfer from one “staff generation” to another is a key aspect for a successful prolonged interim storage with the goal of a safe final disposal. Furthermore taking part in ongoing international discussions and sharing expertise in licensing procedures with international partners has to be continued and deepened as the connection between the European countries will be further intertwined.

5. Conclusion


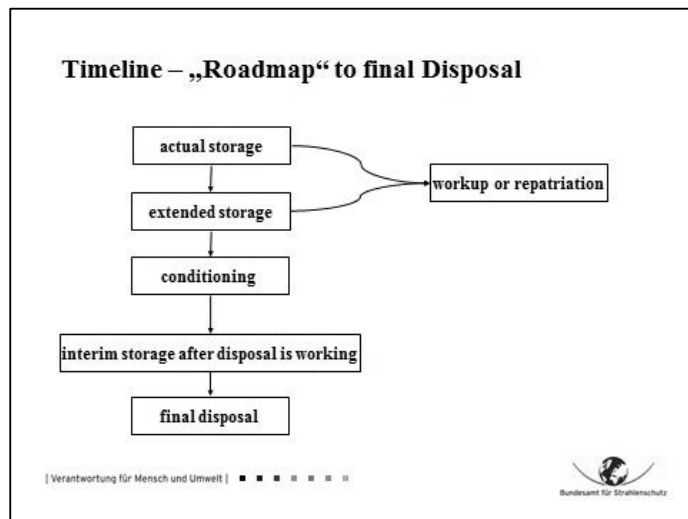
The Federal Office for Radiation Protection is and will be challenged in several ways in the field of prolonged interim storage. As depicted the timeframe will require a close monitoring of present and future changes in the field, including technological, scientific and regulatory changes. Beside the normal licensing process, it is therefore necessary to keep, maintain and establish a sufficient amount of personal to successfully fulfil those challenges. Each separate step in the timeline until a final disposal facility is in operation will influence the work of the regulatory body. As changes in design, eventual delays in search and preparation of the final disposal site are probable to happen, the challenges for the regulatory body will change and therefore generation, accumulating and reviewing of the knowledge in the field of interim storage is imminent for a safe and secure storage until the final disposal is made possible.

International Workshop on Safety of Long Term Interim Storage Facilities

Actual Situation and further development of interim storage of spent nuclear fuel (SNF) and highly active waste (HAW) from the view of the competent authority in the field of §6 atomic law in Germany

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Timeline and respective developments

	Now and till the end of NPP service	End of NPP service 2022	End of actual licensed storage period	Till final disposal
required regulators actions:	License Modifications and one new storage site	Interim storage sites have to be autarc	Renewal of licenses (incl. Results of PSÜ)	Modifications because of eg. PSÜ results

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Situation in Germany


- In 2002 interim storage for a period of 40 years started in Lingen
- In 2022 the last 3 NP's (Isar 2, GKN 2, Lingen) will be shut down.

⇒ About ten years later the disassembling will be done.

But the storage will last until the last cask is moved to a repository. As this is bound to take some time, the knowledge has to be gathered and conserved

⇒ In future storage licences the need for qualified persons should be included.


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Changes in storage concepts driven by:

- Public interests or local authorities
- Change of the owner of SNF
- Consequences because of accidents and happenings during storage
- Planning for conditioning for final disposal
- Needs because of development of state of the art
- Possible partial or complete centralisation of storage


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Safety aspects for extended interim storage

fuel matrix	mechanical integrity gas evolution
cladding	H ₂ brittlement heat influence
baskett	H ₂ brittlement shielding material
body	internal cladding degradation of moderator material corrosion on outer surface
cask	
lid system	bolts relaxation seal pressure switch

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Safety aspects for extended interim storage

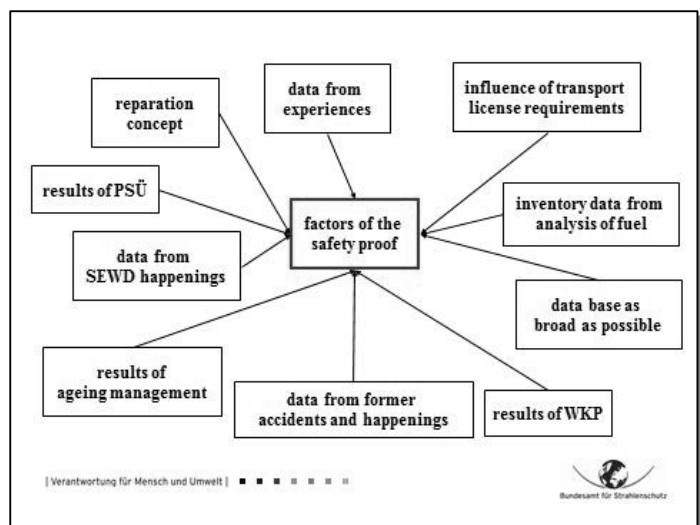
technical installations	way of documentation crane equipment radiation protection
buildings	ground water changes estimated lifetime corrosion
storage site	development of the surrounding airtraffic changes

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Proof of license : „According to actual regulations“

- Knowledge management including gathered information
- Verify and compare the actual situation with state of the art at licensing time
- Precautions according state of the art
- Ensure competency and qualification of applicants and their staff
- Necessary provision for accidents and damage

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Development of laws and technical rules within:

National level

- atomic law: changes will be necessary with the end of NPP service
- environmental laws
- radiation protection
- KTA-rules development
- „Leitlinie“ for safe storage of SNF or HAW

European Union

- national law is influenced (eq. harmonization of laws)
- different member states have different safety philosophies



Preparation for final disposal:

- During future licensing procedures precautions for final disposal have to be addressed
- Prolongation of interim storage has to be integrated in the search for a final disposal facility
- Safety case for final disposal facility has to be based on data gained during interim storage
- If future conditioning or repacking is planned this should be sorted out as soon as possible



Tasks for the competent authority:

Now: personal and logical resources to deal with actually applied licenses are tight

- Modification of current storage licenses
- Modifications of licenses due to needs after NPP shutdown
- Modifications of licenses to reach autarcy of interim storage facilities



Tasks for the competent authority:

Soon: knowledge management, including securing necessary amount of qualified staff including for instance:

- taking part in international discussions (esp. after NPP shutdown)
- qualifications to judge the knowhow
- time for gathering informations and training in relevant fields

Thanks for Your attention!