Note:
This is a translation of the document entitled "ESK-Empfehlungen für Leitlinien zur Durchführung von periodischen Sicherheitsüberprüfungen für Zwischenlager für bestrahlte Brennelemente und Wärme entwickelnde radioaktive Abfälle (PSÜ-ZL)".
In case of discrepancies between the English translation and the German original, the original shall prevail.

ESK

ESK recommendations for guides to the performance of periodic safety reviews for storage facilities for spent fuel and heat-generating radioactive waste (PSÜ-ZL)

RECOMMENDATION

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0 Preface

With letter of 25.11.2009, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) commissioned the ESK to give recommendations on content, scope and time period for the periodic safety reviews for dry storage of spent fuel and high active vitrified waste in containers (PSÜ-ZL).

The necessity of corresponding regulations derives from the so-called Safety Reference Levels of WENRA [3], to whose implementation in the rules and regulations and in practice Germany has committed itself as a WENRA Member State, as well as from the requirements for storage in the EURATOM Nuclear Safety Directive [5].

According to the BMU it is planned with regard to the implementation of these recommendations to conduct a two-year test phase in which the performance of a PSÜ-ZL will be tested for selected storage facilities.

The ESK recommends subjecting these recommendations to a discussion process with the interested/concerned institutions during this two-year test phase under the auspices of the ESK. The results of this discussion process should be considered in the final preparation of guidelines.

In developing the present guideline recommendations, several issues were identified that should be considered from the ESK's point of view in the final drafting of guidelines for the PSÜ-ZL, and in a future revision of the RSK guidelines [1]. These are summarised in a checklist.

The ESK considers it appropriate to review the guides to the implementation of the PSÜ-ZL and dry storage in casks at reasonable intervals also in future (e. g. every 5 years) and to make any necessary adjustments.

1 Introduction

Storage facilities for spent fuel and other heat-generating radioactive waste are operated in Germany on the basis of a licence issued pursuant to § 6 of the Atomic Energy Act (AtG) and a storage licence which is currently generally limited to 40 years. They are subject to governmental supervision during construction, operation and decommissioning and in case of modifications of the storage facility and its operation mode if areas important to safety are concerned. Any potential interactions due to a combined or mixed storage with non-heat-generating radioactive waste in connection with licences pursuant to § 7 of the Radiation Protection Ordinance (StrlSchV) are to be taken into account.

The central safety element of dry storage of spent fuel and other heat-generating radioactive waste are accident-resistant transport and storage casks licensed under traffic law at the time of emplacement[1] and whose transportability must also be ensured for later removal. With the granting of the licence, safe enclosure of the radioactive inventory, adequate shielding of radioactive radiation, maintenance of subcriticality and the safe removal of decay heat in accordance with the state of the art in science and technology are assessed and confirmed as fundamental protection goals.

[1] The checklist includes information on the issue of transportability of the casks during the period of emplacement.

Compliance with the requirements for the safe operation of the storage facility, made mandatory with the storage licence, is to be ensured by the safety management of the operator. For the subsequent storage, significant operational boundary conditions arise from cask manufacturing, loading and handling. Both the operators and the authorities with their authorised experts have adequate instruments for the exchange of experience, such as the "co-ordination office for information on cask handling" (KOBAF) and the "VGB Working Panel Cask Handling and Storage" (BAL).

As part of regulatory supervision, the condition of the storage facility and its operation is checked for compliance with the provisions of the licensing decisions. In this context, the necessity of the implementation of new safety-related knowledge resulting from operating experience is also examined by the operator and the authorities.

2 Scope of application

The guidelines are applicable to storage facilities for dry storage of spent fuel and heat-generating radioactive waste in casks.[2]

The periodic safety review of storage (PSÜ-ZL) is conducted – also in the case of on-site storage facilities – independently of the PSR in the nuclear power plants.

What is stated in this paper on the PSÜ-ZL refers to the deterministic safety status analysis in terms of the PSR guidelines for nuclear power plants [2]. A probabilistic safety analysis is not required, since the emphasis is on passive safety functions. Active measures exclusively serve to monitor the condition (e. g. the lid sealing system) and the boundary conditions (e. g. ventilation, environmental influences).

The guidelines do not contain any provisions regarding the physical protection of storage facilities.

Where it is justified from a technical perspective, the guidelines also contain requirements for the review of the PSÜ-ZL and the resulting requirements for the authorities.

[2] Regarding the scope of application, also refer to the checklist.

3 Objectives of the PSÜ-ZL

In the course of a longer period of operation, the safety-related knowledge is broadened; the methods and instruments for safety analyses are further developed. This should lead to a continued development of the plant's safety status and its operational safety. It is therefore advisable to perform an overall safety review for each operating storage facility at appropriate intervals. To this end, the PSÜ-ZL is an element of the safety management of the operator, and its review represents an instrument of ongoing supervisory activities of the authorities. Starting with commissioning, it is to be conducted at regular intervals for each storage facility in operation. Here, the plant-specific operating experience since the last PSÜ-ZL is to be evaluated, also taking into account relevant operating experience from other storage facilities.

With the PSÜ-ZL, the following objectives are pursued in accordance with the procedures in nuclear power plants:

- Summarised documentation and evaluation of all events and findings within the review period with regard to the safety level and operating reliability of the storage facility, and minimisation of the radiation exposure,
- up-to-date safety assessment in accordance with the state of the art in science and technology with regard to
  - the safe and reliable continued operation of the storage facility,
  - the impacts of ageing mechanisms on the condition of the storage facility and its installations, and on the transport and storage casks and their inventories,
  - the compliance with the safety requirements for the handling and later removal of the transport and storage casks, and
- derivation of findings and measures for further operation.

The result of the PSÜ-ZL should demonstrate the fulfilment of the protection goals
- confinement of radioactive material,
- radiation shielding,
- maintenance of subcriticality,
- removal of decay heat,

and the resulting requirements with regard to

- design, execution and quality assurance suitable for operation and maintenance,
- the safety-oriented organisation and performance of operation,
- the design against accidents (availability and effectiveness of the required safety functions), the measures provided for beyond design basis events, and
- the safe removal of the radioactive material

for the remaining licensed operating life.

4 Principles of the PSÜ-ZL

4.1 Responsibilities

The operator of the storage facility is responsible for carrying out the PSÜ-ZL. The PSÜ-ZL and its results and the measures derived are to be documented transparently by the operator and submitted to the supervisory authority.

The nuclear supervisory authority is responsible for the assessment of the PSÜ-ZL carried out by the operator. The supervisory authority uses the periodic safety review to complement its ongoing supervisory activities and presents the results of it review in a summary report, which is made available to the nuclear licensing authority. Where required, the supervisory authority defines necessary measures for the continued operation of the storage facility reviewed and monitors, as part of its supervisory activities, their timely and proper implementation.

The nuclear licensing authority (Federal Office for Radiation Protection) takes note of the results of the periodic safety review of the storage facilities as well as of their assessment by the supervisory authority and, if necessary, may derive updated or additional requirements for ongoing or future licensing procedures.

4.2 Periods

The periodic safety review is to be conducted for each intermediate storage facility after the start of operation, i. e. after emplacement of the first loaded container, for the first time after 10 years, and then at intervals of 10 years.

About 6 months after completion of the periodic safety review and submission of the report by the operator, the supervisory authority should submit the summary report of its review results.

4.3 Structure

The structure of the PSÜ-ZL should be based on the existing safety concept for storage facilities (see [1]).

The deterministic safety status analysis to be carried out with the PSÜ-ZL includes a protection goal oriented review of the safety status of the storage facility with a description and evaluation of operational management (safety management) and evaluation of operating experience.

The results are to be summarised as part of the final review of the safety status of the storage facility. Here, emphasis is placed on the protection goal oriented review by demonstrating that the protection goals mentioned in Chapter 3 are complied with during normal operation and design basis accidents, and that precautions have been taken for beyond design basis events. Based on this structure, Chapter 5 specifies the contents of the PSÜ-ZL.

4.4 General assessment basis and objectives

The assessment basis for the PSÜ-ZL are laws, ordinances and the applicable technical rules and regulations in the Federal Republic of Germany, operating experience and the state of the art in science and technology. International regulations are to be used as a guide, as far as it is envisaged to transpose them into national regulations, such as the WENRA Safety Reference Levels [3].

5 Scope of the PSÜ-ZL

5.1 Up-to-date description of the facility

The deterministic safety status analysis has to be preceded by a description of the storage facility. It serves the purpose of giving an up-to-date survey of the safety concept, the design features of the storage facility and of all safety-relevant measures.

The description of the facility is structured in accordance with the safety report on the basis of which the storage facility is licensed.

5.2 Survey of the safety-relevant changes performed or occurred during the period under review

For the survey of the safety-relevant changes performed or occurred during the period under review, the following aspects have to be taken into account.

- Changes in the licensing status: modification licences issued; subsequently imposed licence conditions,
- changed regulatory requirements,
- organisational changes,
- modifications of the storage facility: refitting; repairs and retrofitting, amendment of the regulations on operation, maintenance and testing,
- changes in the operating condition of the storage facility: changes with regard to the emplaced inventory, the heat output, or capacity utilisation,
- changes in the site conditions,
- interactions with neighbouring facilities and installations.

The compilation of the safety-relevant changes performed or occurred during the period under review serves to supplement the up-to-date description of the facility and provides the basis for the overall assessment of the safety status of the storage facility (as described in Chapter 6.1).

5.3 Evaluation of operating experience

The evaluation of the safety-relevant operating experience should include the following areas of the facility's own and external experience:

- Operating experience in the storage facility (experience in operational management, evaluation of the results of in-service inspections and other test results, findings from routine and individual inspections, non-conformances identified, events),
- reliability of components,
- radiation exposure of personnel (total, during specific activities),
- experiences from information notices,
- operating experience in comparable storage facilities (evaluation of operating reports, information from expert committees, other findings).

The evaluation of operating experience serves to review the operational efficiency of the safety-related plant design, the reliability of safety-relevant systems and compliance with the protection goals.

5.4 Accident analysis

The aim of the accident analysis is to examine whether the relevant safety functions (see [2]) are available and effective. Here, the accident spectrum on which the licence is based is to be considered, and it is to be checked whether additional relevant event sequences must be taken into account from experience from comparable storage facilities or amendments to the applicable rules and regulations. The accident analyses submitted must be checked as to whether the safety requirements are also complied with for the specified representative events under the current boundary conditions, taking into account the state of the art in science and technology.

The measures specified in the operating manual for beyond design basis events in the operating manual are to be reviewed.

5.5 Review with regard to technical ageing

With regard to technical ageing, reviews are to be performed and evaluated and the results are to be presented.

As part of the PSÜ-ZL, the measures existing for the storage facility with regard to technical ageing (ageing management) are to be reviewed.

5.6 Safety management

As part of the PSÜ-ZL, the following aspects of safety management are to be subjected to a review:

- Operational organisation of the operator and assignment of powers and responsibilities with regard to the safety-relevant functions of the storage facility
- Definition and documentation of the safety-relevant processes and monitoring of the quality of processes, e. g. on the basis of performance indicators and results of audits
- Up-to-dateness of the operating instructions and measures for beyond design basis events
- Measures for maintaining the requisite technical qualification of the operating personnel responsible for storage and for ensuring the provision of the necessary resources and competences
- Measures for the evaluation of operating experience (as described in Chapter 5.3)
- Up-to-dateness and completeness of the management systems being relevant with regard to nuclear law

Results from the regular reviews of the safety management carried out during the period under review are also to be included in the review.

The review of safety management serves to verify the availability of appropriate organisational and personnel measures and their safety-oriented interaction with the engineered safety features.

6 Results of the PSÜ-ZL

6.1 Final assessment and documentation by the operator

At the end of a PSÜ-ZL, the licensee should provide a safety assessment of the storage facility. For this purpose, the results of the respective analyses have to be summarised for an informative overall picture. The assessment criterion is the fulfilment of the protection goals according to Chapter 3. Where necessary, safety improvements will be described and included in an action plan.

The individual analyses and results should be summarised and submitted to the competent supervisory authority as documentation for the PSÜ-ZL.

The contents of the report should be verifiable; the documents used have to be stated. In analogy to the PSR guidelines [2], it should focus on the following issues:

- Current plant description,
- report on operational management and operating experience,
- description and results of the deterministic protection goal oriented review,
- final assessment of the safety status, involving the individual results for the parts of the PSÜ-ZL.

6.2 Assessment by the authority

The nuclear supervisory authority assesses the safety status of the storage facilities described in the documentation submitted on the PSÜ-ZL.

To assess the safety significance of these results, the following criteria should be applied (in accordance with [2]):

- The evaluation of operating experience shows sufficient reliability of the respective components and equipment.
- The existing safety installations limit the consequences of the specified representative design-basis accidents to be considered with the required effectiveness and reliability in accordance with the protection goal oriented requirements.
- Weaknesses in the safety concept will be identified.
- The action plan proposed for the case of safety-relevant non-compliances is suitable for improving the safety status of the storage facility.

The improvement measures to be taken are determined by the operator in agreement with the competent authority.

References

[1] Reactor Safety Commission: Safety guidelines for dry interim storage of irradiated fuel assemblies in storage casks, recommendation of the Reactor Safety Commission, 05.04.2001

[2] Federal Ministry for the Environment, Nature Conservation and Nuclear Safety: Announcement of the Guidelines for Conducting Periodic Safety Reviews (PSRs) for Nuclear Power Plants in the Federal Republic of Germany. Bonn 18. August 1997

[3] WENRA Working Group on Waste and Decommissioning (WGWD): Waste and Spent Fuel Storage Safety Reference Levels Report - Version 2.0, Draft, To be published

[4] Reactor Safety Commission: Safety requirements on the interim storage of low and intermediate level waste in the longer term, as amended on 05.12.2002 with new wording in Section 2.7.1 (third bullet) of 16.10.2003

[5] Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations, Official Journal of the European Union L 172/18 of 2.7.2009