THE PROCEDURE FOR CHANGES OF THE LICENSED STATUS FOR A REPOSITORY FOR NUCLEAR WASTE

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ABSTRACT

The required safety of a repository for radioactive waste has to be shown by a site-specific safety assessment covering the operational and post-operational phase. In order to verify in a traceable manner that the necessary precautionary measures against damage have been taken in the design phase and remain unchanged during construction and operation, the implementation of a quality management system is necessary for a waste repository as applied successfully in other nuclear facilities. Changes of design or operational procedures in German waste repositories are divided into four categories according to their nonconformance with the licensing documentation and their relevance to safety. The German procedure for changes during the operation of a waste repository is described and examples for changes of the first three categories and review and approval of change records to be followed are given.

INTRODUCTION

In the Federal Republic of Germany the Federal Office for Radiation Protection (Bundesamt für Strahlenschutz - BfS) is legally resonsible for construction and operation (including decommissioning) of geological repositories for radioactive waste. The required safety of such a repository in its operational and post-closure phases must be demonstrated according to the German "Safety Criteria for the Disposal of Radioactive Waste in a Mine" (1) by a site-specific safety assessment including the overall geological situation, the technical concept of the repository and the waste packages intended to be disposed of.

Quality management (QM) in radioactive waste disposal encompasses all management activities related to quality. QM takes care of the safety due to the fulfillment of the respective requirements and enables the required safety for a repository, starting with the siting and ending with the decommissioning. In order to verify that the necessary precautionary measures against damage have been taken in the design phase and remain unchanged during construction and operation, the implementation of quality systems is essential for a repository. Therefore, within the quality systems, procedures are elaborated which have to be applied by the applicant in the respective licensing procedure and by the operator for design and operation of repositories as well as for technical or administrative changes in these phases.

Within the BfS the responsibility for the surveillance of the quality related work is shared by two organizational units which is shown by Fig. 1:

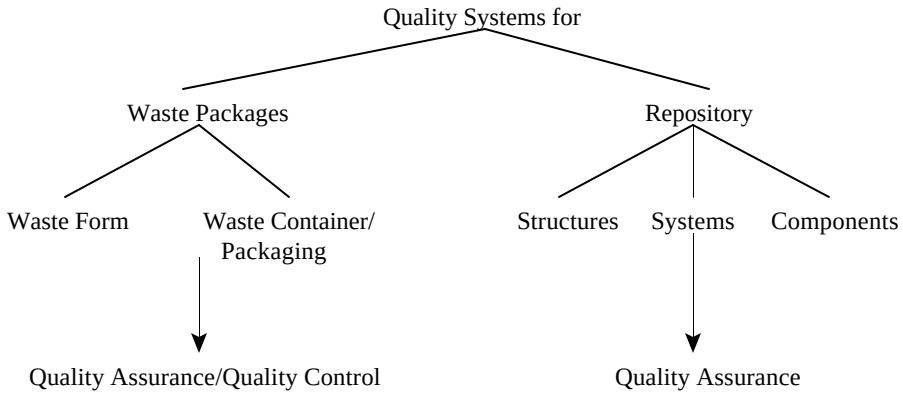

Fig. 1: Quality Management Activities

The most important task of quality management related to structures, systems and components of a geological repository is the necessity of an appropriate recording of, e.g., test results, safety assessment calculations and quality records in order to ensure the safety of the repository and the appropriate grading of the components in a traceable manner.

As to the safety of a repository during its operational and post-operational phases, the waste acceptance requirements are in particular of importance. They are based on the results of site-specific safety assessments and define the envelope the waste packages intended for disposal must comply with. To ensure safety, the fulfillment of such requirements has to be demonstrated within the waste package quality system. Typical measures concentrate on sampling inspections, qualification of conditioning processes or testing of waste containers (2).

Quality is as well a measure to define the characteristics of structures, systems and components of a repository as wanted for compliance with stipulated requirements. Compliance with requirements regarding physical characteristics is shown as the fulfillment of quality. Repository quality assurance (QA) is the entirety of all organizational and technical measures to assure and prove the quality of structures, systems and components.

The repository QA framework is mainly based on the requirements of the regulations of the German Nuclear Standard KTA 1401 (3) and of the European Standard EN DIN ISO 9001 (4) as far as applicable. It should be pointed out that no repository-specific regulations exist in the Federal Republic of Germany. Proper QA concerns all parts of a nuclear installation, i.e., in particular, safety and reliability are positively influenced. This requires a pragmatic and meaningful quality assurance program, which has been developed by BfS focusing on the specific aspects of a repository in deep geological formations.

QA AREAS

QA requirements for a waste repository are subdivided into three areas with respect to different requirements of the quality assurance measures to be taken and are defined as in (5).

(a) QA area 1 for site investigations,

(b) QA area 2 for non-nuclear safety-related structures, systems and components,

(c) QA area 3 for nuclear safety-related structures, systems and components.

Quality assurance in the QA area 1 is performed by the choice of appropriate suppliers and a comprehensive supervision of their work and individual checks by BfS itself or experts on behalf of BfS. It should be pointed out, that main expert organizations performing the safety assessments and providing the geological data in Germany have introduced their own Quality system or even got a certification fulfilling the standard cited in DIN EN ISO 9001 (4). For the classification of structures, systems and components QA area 1 is not applied.

The quality assurance of QA area 2 is ensured by enabling the fulfillment of the QA requirements resulting from conventional technical and industrial rules including regulations of the mining authorities. This fulfillment is proven by measures like acceptance tests or review and approval of documents.

In the case of QA area 3, in addition to the conventional and industrial rules, requirements resulting from nuclear aspects and existing nuclear regulations and standards - if necessary from the safety point of view and applicable for waste repositories - have to be fulfilled. This is proven by measures like surveillance of the suppliers and manufacturers as well as by acceptance tests or review and approval of the respective documents.

MODIFICATIONS DURING DESIGN

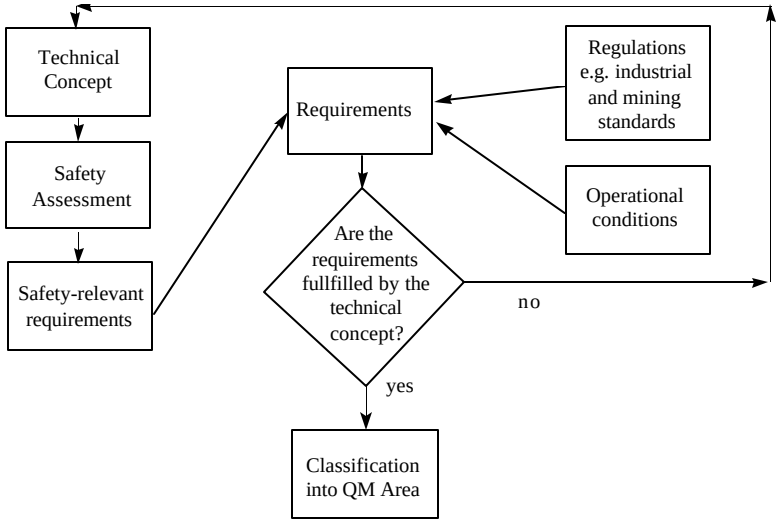

Fig. 2: Procedure for modifications during design

For the design of structures, systems and components BfS and its contractors proceeded as laid down in Fig. 2. Based on a first design of a technical concept a safety assessment was performed. One of the results were safety relevant requirements for the design of the structures, systems and components. Together with further requirements of operational conditions, rules and regulations one had to check if the requirements e.g. of the occupational health rules and regulations are fulfilled by the technical concept, if not, the technical concept had to be altered and the loop started again until a classification into a QA area was possible.

It is reasonable to differentiate between modification during design and changes during operation because there is a difference in quality of the procedure. In the latter case, approval of authorities are necessary whereas in case of modifications during design BfS can decide on basis of the results provided by the safety assessment.

CHANGES DURING OPERATION

For the operational phase of a repository, an appropriate change procedure is vital. A change refers to the change of a licensing document or the licensed operating mode of the plant to be in line with a new planned condition. Thus, a change is the transfer of a licensed plant or a licensed operation into a new status.

Reasons for changes are for example, new equipment due to new knowledge of the state of art, new requirements from the licensing authority or due to new operational knowledge or a change of the respective responsible personal.

The procedure for changes does not apply to maintenance activities and has to ensure that:

- all changes are performed in accordance to this procedure,
- all departments etc. affected by the changes are notified and involved in this procedure,
- all changes are recorded in a traceable manner.

BfS is the authority responsible for the submittal of a complete and correct application for changes and its review. The Self-Surveillance Department, which is an independent organizational unit of BfS is responsible for checking whether changes affect the license issued and the category of the change.

BfS divided changes into four categories (6) in accordance with their nonconformance with the licensing documentation and their relevance to safety (cf. Fig. 3). This approach was derived from the procedure, which is used for changes in nuclear power plants in Germany. The schematic procedure as applied for waste repositories is shown in Fig. 4.

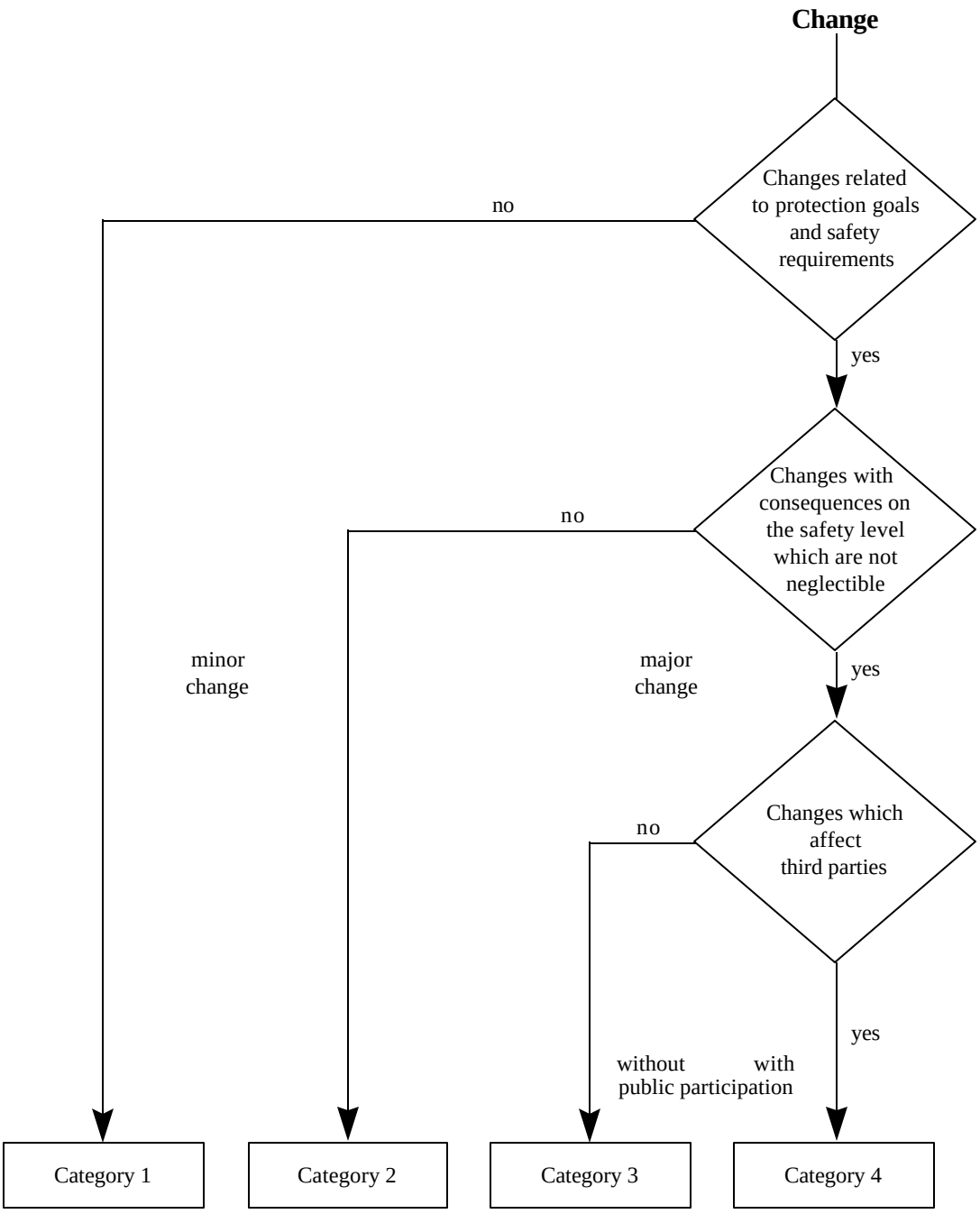

Fig. 3: Classification of changes to the licensed status

Changes of the Category 1 are changes without any affect on the licensing documents and include for example:

- nonconformances with documents which are not included in the license,
- nonconformances in the as-built condition of structures, systems and components or operation which are laid down in procedures (i.e. nonconformance with the stipulated design within the limits of the design possibilities allowed by the licensing document).

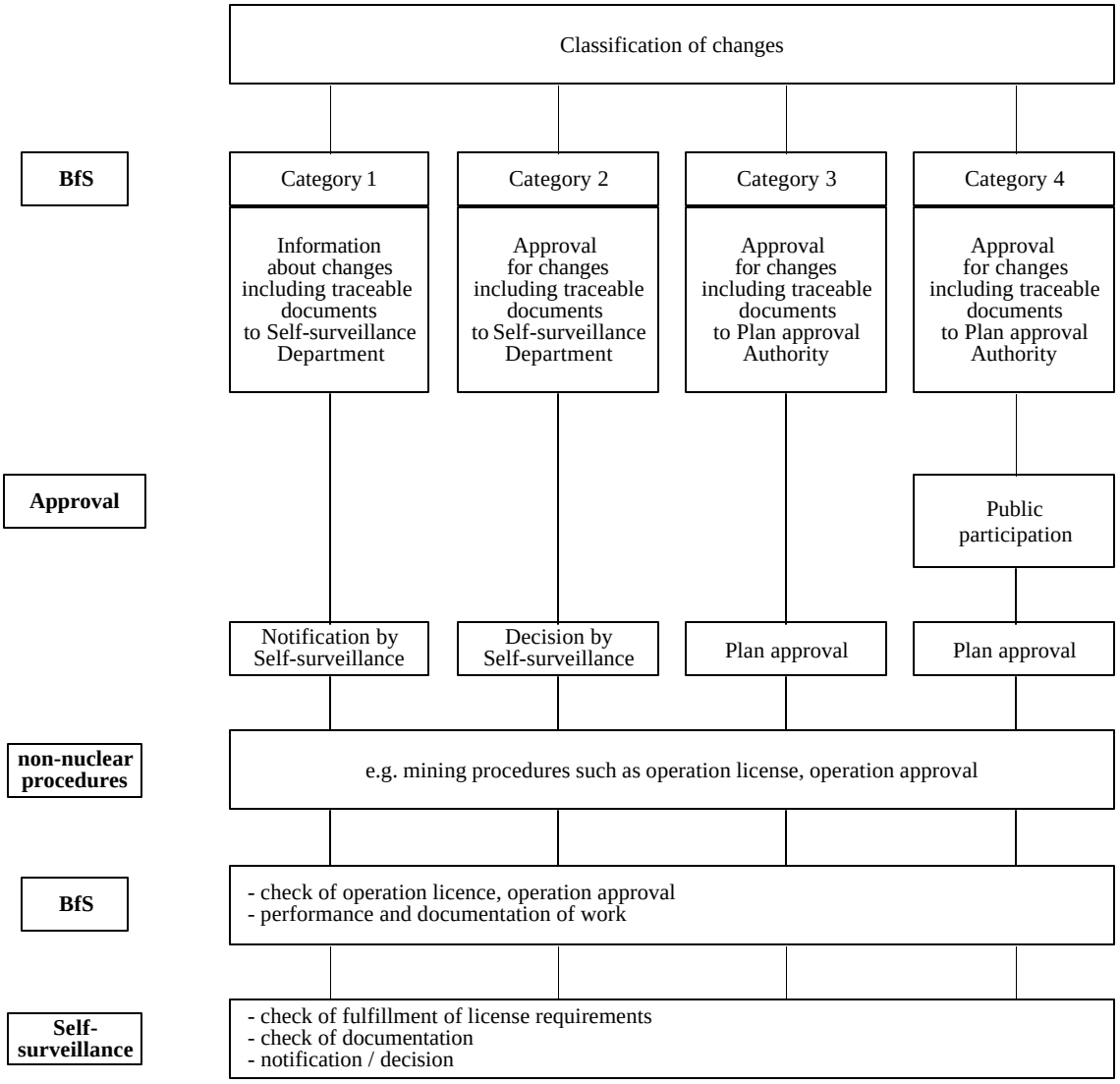

Fig. 4: Schematic procedure in case of changes to the licensed status

Changes of the Category 2 are minor changes to structures, systems, components, operating mode or documentation, which affect the licensing documents, which do not affect the protection goals and safety requirements.

Changes of the Categories 3 and 4 are major changes without or with participation of the general public, which have consequences on the safety level, which are not neglectible. Measurements for classification into the Categories are for example the protection goals, the safety concept, the licensed activity inventory, the limited release of activity.

The QA areas and the categories are related as follows:

Category of changes	1	2	3/4
QA area 2	a	b	/
QA area 3	/	c	d

a Changes without relation to protection goals and safety requirements: Notification by the Self-Surveillance Department

b All other changes related to QA area 2: Decision by the Self-Surveillance Department

c Changes with no consequences on the safety level: Decision by the Self-Surveillance Department

d All other changes related to QA area 3: Plan approval procedure with or without public participation

Examples for changes of Category 1 are:

- Dismantling of a storage for oil and grease
- Renewal of the telephone installation
- First use of a laser device in underground facilities for leveling and redeposition of excavated material to a different place
- Replacement of obsolet or use of additional measure devices by identical modern devices, considering the prerequisite that the use of those devices has been licensed by the Mining Authority
- Move of measurement devices for ventilation survey measurements to another position

because they have no nuclear relevance.

Examples for changes of Category 2 are:

- Use of a second truck for transport of waste units under ground
- Exchange of an aged installation for the surveillance of the local dose rate
- Use of modified packings (e.g. cast iron containers or box-shaped-containers) instead of 200 l drums as packages for radioactive waste
- Actualization of radiation protection relevant operation procedures (e.g. radiation protection procedure)
- Preparation of disposal romms for the emplacement of waste packages according to the license.

These changes have been assigned to Category 2 because they are nuclear relevant, but do not require an overall review of the safety level of the repository.

Examples for changes of Category 3 are:

- Change of responsible persons according to the Atomic Energy Act, which are specified in the license.
- Extension of the license on the handling with further radioactive material
- Licensed use for neutron sources of nuclear material.

Examples for changes of Category 4 might be:

- Enhancement of activity release into the environment
- Enhancement of the activity inventory to be disposed of by more than 10%.

BfS is the authority responsible for the submittal of a complete and correct application for changes and its review. The Self-Surveillance Department (SSD), which is an independent organizational unit of BfS is responsible for checking whether changes affect the license issued and for approving the category of the change.

Since 1993 until October 2000 the Self-Surveillance Department (SSD) passed and completed 249 applications for change. Out of these, 149 changes were assigned to Category 1, 87 changes were assigned to Category 2 and 13 changes were assigned to Category 3. There has been no application for a Category 4 change.

For these tasks the SSD follows the requirements of § 19 of the German Atomic Energy Act and of the QM procedures "Approval and Release of records" as well as "Proceeding with changes". The approval and release takes place after safety and legal checks, which are recorded in an independent record system. If the SSD agreed to a nuclear relevant change of structures, systems, components or operational procedures, the start of operation follows a three step procedure:

- test with inactive items,
- test with active items for a limited time,
- permanent operation,

which will be monitored by SSD. This approach serves as a check of the operational dependability due to the change.

Furthermore the SSD performs inspections to ensure that the operation of the repository is in compliance with the licensed status and observes if determined nonconformances were removed.

This change procedure, elaborated for the planned Konrad repository, was applied to the Morsleben repository. This repository was used in the former German Democratic Republic for disposal of short-lived low and intermediate level waste with rather low alpha emitter concentration. Subsequent to German unity the Morsleben facility has the status of a federal repository. This facility has resumed its operation in mid-January 1994 up to September 1998. On the basis of recommendations resulting from a safety assessment, improvements were made not only optimizing the safety state, but emplacement procedures as well. At present BfS is elaborating the licensing documents for the decommissioning of the Morsleben repository.

INTERNATIONAL APPROACH FOR CHANGES

Changes related to plant configuration are defined in the approach recommended by the International Atomic Energy Agency (IAEA) as any permanent and temporary alteration to structures, systems, components, process software, to operational limits and conditions, and to operating procedures. This includes any replacement or refurbishment to existing structures, systems , and components. This definition does not include replacement of a component by an equivalent component in connection with recognized maintenance activities. In this context, 'an equivalent component' is defined as either one which is identical to the original component or one for which a safety assessment has previously been made and confirmed, in accordance with the change control procedure, so that it can be regarded as an equivalent replacement for the original component.

Changes may be necessary to rectify component failures discovered during operation, inspection or maintenance, to reduce the frequency of faults, to improve maintainability, to incorporate a non-identical replacement of a plant component, to take into account safety standards evolution.

The IAEA classifies changes as follows (7):

Changes of category 1 contain minor changes that could be characterized in one of the following ways:

- the change has no consequences for safety;
- the items to be modified are classified as items not important to safety and are not addressed in the licensing documents, such as technical specifications; and
- the change, even if designed or implemented incorrectly, could not lead to a significant increase of risk.
- Changes in this category should be reported to the regulatory body only as required.

Changes of category 2 refer to changes in safety related items or systems or operational approaches, and usually necessitate an update of the Safety Analysis Report or other licensing documents. Changes in this category are characterized by a minor influence on safety, but no significant alteration to the principles on which plant licensing have been based. There should be no changes to the conclusions in the licensing documents. In the design phase of this category of change it is also necessary to assess whether there are negative side effects, such as degradation of safety features or significant radiation exposure expected during implementation. Changes in this category require contact with the regulatory body, in accordance with established procedures.

Changes of category 3 may have significant consequences on the risk of radiological hazard, or involve an alteration of the principles and conclusions on which the safety of the design and the plant licensing have been based. Such changes may involve changes in the spectrum of accidents to be postulated in design basis, or they may alter the technical solutions adopted for meeting the safety goals or lead to changes in the operating rules. Changes in this category require a thorough analysis and may also require prior approval, an amendment to the operating license or a new license.

Comparing the IAEA approach (7), which will be published in near future, and the BfS categorization one can see, that in the sense of the IAEA approach there is by safety means no difference between categories 3 and 4 of BfS. The main difference is the requirement of public participation in case of category 4 in Germany.

CONCLUSIONS

An essential part of quality management is to provide appropriate procedures to allow verification that necessary safety relevant measures are taken in a traceable manner. One important procedure is the procedure for changes of the licensed status in order to ensure that these changes do not affect the safety level as approved within the licensing procedure. In order to optimize such a procedure an appropriate categorization of changes is necessary. In Germany, four categories are defined reflecting their relevance to safety. This categorization is in general in accordance with international approaches and differs only with respect to the degree of public involvement for major changes.

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