QUALITY CONTROL ASPECTS IN THE TREATMENT, STORAGE AND DISPOSAL OF LOW LEVEL WASTES IN GERMANY

Dr. Eder W. Waldburg
Westendstrasse 199
8000 Muenchen 21

Franz-Josef Schmid
TUV (Germany)

ABSTRACT

In Germany, state control during conditioning, intermediate storage and transport of low and medium level radioactive waste was intensified in 1988. The Ministry of Environment, Nature Conservation and Nuclear Safety published the guideline for the control of radioactive waste.

The quality and quantity of the waste from its generation in the nuclear power plants to its final disposal in the planned Konrad repository is supervised by a computer-aided waste data acquisition and waste flow tracking system.

Prior to disposal of a waste package, the conformance to the waste acceptance requirements for the Konrad repository must be provided through product control; by random checks on existing waste packages or by qualification of the conditioning process with subsequent inspections.

A test and examination sequence plan gives step-by-step information of the whole procedure of a conditioning campaign. Each step is defined, and the organizations responsible for the orderly execution and examination of each step are named. The approval for the disposal of a waste package is certified in a special document.

INTRODUCTION

Licensing and supervision of nuclear facilities and of the safe disposal of their waste in the Federal Republic of Germany are orientated on the federal structure of the state. They are carried out according to the regulatory frame given by the Atomic Energy Act, associated legal provisions, administrative regulations, guidelines of the Reactor Safety Commission, technical rules and industrial standards. Impartial expert organizations as TÜV Bayern are called upon to serve as assessor and consultant for the licensing authorities. It is their role to help to fulfill the requirements of the legal and regulatory background as well as to contribute to the assurance of a specified quality in nuclear technology.

STRUCTURE OF THE NUCLEAR INDUSTRY AND REQUIREMENTS FROM THE COMPETENT AUTHORITIES

The interim storage, final disposal and transportation of radioactive waste has been generally defined since the very beginning of the peaceful use of nuclear energy in our country (1). Since the amount of radioactive waste has grown with the years of operating nuclear power plants the demand for more specific regulations have become more urgent.

In 1987, some irregularities in the disposal of radioactive waste in the FRG were disclosed. At the same time, an unexpected gas production was observed in some waste packages. These incidents accelerated administrative and engineering measures to avoid further irregularities. It was the intention of the competent authorities in Germany to intensify state control during the conditioning, intermediate storage and transport of low and medium level waste. The operator of final nuclear depositories in Germany is the Federal Government.

In 1987, the Minister for Environment, Nature and Nuclear Safety (BMU) presented the concept for a new structure of the nuclear industry. As a result of this concept, only one company is responsible for the management of radioactive waste with negligible heat generation. The company entrusted with this task is the Company for Nuclear Service (GNS mbH).

The company is responsible for all tasks of conditioning, handling and interim storage of radioactive waste within the nuclear industry.

The German Federal Railway (DB) has the responsibility of transporting all kinds of nuclear fuel and radioactive waste within Germany. The DB also holds the required transport-license from the competent authority.

In 1989 the "Guideline for the Control of Radioactive Waste with Negligible Heat Generation..." was published (2).

The new guideline provides that the responsibility of the waste producers and of those concerned with treatment, storage and transport of low level waste is assigned in each individual case and that the qualitative and quantitative registration of all waste streams are ensured.

The responsibility for the disposal of radioactive waste was transferred from the Physikalisch-Technische

Bundesanstalt (PTB) to the newly formed Federal Office for Radiation Protection (BfS) in 1989 (3).

These more centralized principles and regulations are still in effect, especially with respect to transport and final disposal in the planned Konrad repository.

The Konrad repository is a former iron ore mine. It is planned to dispose of radioactive waste with negligible thermal effects in the host rock formation of this mine.

Requirements for the Konrad repository have been derived from the safety analysis at the operational phase. This is the basis for the waste acceptance criteria to be met by a waste package, which is to be disposed of in the Konrad repository. Compliance with the waste acceptance criteria is verified within the framework of the waste package quality control.

This means, that prior to the disposal of the waste package, the conformance to the requirements must be provided through product control.

WASTE ACCEPTANCE REQUIREMENTS AND QUALITY CONTROL (QC)

In accordance with the Safety Criteria and the site-specific assessment, preliminary waste acceptance requirements were established for the planned Konrad repository. These requirements impose limitations mainly on the waste form, the packaging and the content of radioactivity (4, 5).

- All waste forms must be solidified and they must neither rot more ferment.
- Standardized packaging is to be used for the disposal of radioactive wastes in the Konrad repository.
- Maximum permissible activities of the long-lived radionuclides or radionuclide groups (e.g., non-specified alpha and beta/gamma emitters) are given per waste package.

According to German regulations, the organization for the quality control in the FRG has the following scheme:

- The producer of radioactive waste is responsible for the quality of the waste during the whole conditioning phase, for the transport and for the final repository.
- Impartial expert organizations guarantee the observance of the waste acceptance agreements. They check the documentation of the waste producer, do random checks on conditioned radioactive waste, approve the qualification and instrumentation of conditioning processes and control the qualified processes.
- At the final repository, the last check for final disposal is performed. As the waste packages are checked for their compliance with the waste acceptance requirements before they are transported to the repository, the entrance control can be limited to a few fundamental data of the waste packages (e.g., identification, weight, dose rate, surface contamination).
- If the radioactive waste packages meet the waste acceptance requirements of the final repository they will be accepted.

As mentioned above, it is principally possible to carry out the checks by two alternative methods:

- Random checks on existing waste packages or
- Qualification of conditioning processes with subsequent inspections.

Priority is given to the qualification of the process. But for about 70,000 waste drums which already exist as well as for a smaller number of lost concrete and cast iron containers random checks are the only way possible (6).

Random Checks on Waste Packages

Radioactive waste which has been conditioned by a facility without qualification has to undergo random checks. The waste packages to be checked are selected by statistical methods or in addition as a result of a visual inspection. The documentation to be provided by the waste process is also taken into consideration. The number of waste packages belonging to an inspection lot is limited.

Random checks are possible by non-destructive and destructive techniques:

The non-destructive techniques are easier to handle but are limited to properties which can be measured outside the item.

Destructive sampling requires more complicated transportation and handling procedures but it is necessary if important properties and nuclides cannot be derived from non-destructive testing and calculation. Destructive sampling can most effectively be done by drilling. In this case, the properties and nuclides can be determined from the dust of the samples.

Non-destructive techniques are:

- Visual inspection,
- Dose rate and neutron measurement,
- Measurement of loose surface contamination,
- Weighing,
- Gamma spectrometry and
- Gas sampling.

Destructive techniques are:

- Opening of the waste package,
  - Visual inspection,
  - Free liquids,
  - Compressive strength,
- Sampling and sample analysis (7).

Qualification of the Conditioning Process

By qualifying the conditioning process destructive or non-destructive, tests of waste packages can be avoided. The quality can be guaranteed by a qualification of a duly instrumented conditioning process with subsequent process inspections. In the course of the qualification of conditioning processes, it must be demonstrated by inactive and/or active runs that waste packages are produced which fulfill the waste acceptance requirements. The qualification process results will be compiled into a handbook for the operation of the respective conditioning process. This handbook includes the process instrumentation and the operational margins. The qualified process will be inspected to assure the compliance of the actual operation with the conditions fixed in the handbook (8).

QUALITY ASSURANCE (QA)

The "Guideline for the Control of Radioactive Waste..." requires the waste producer to record and survey the quality and quantity of the waste from its origin to its final disposal. For this purpose, computer supported waste data acquisition and waste flow tracking system AVK have been initiated.

This is a powerful tool for the complete supervision of all possible waste flow routes from the generation in the nuclear power plants to the final disposal.

The AVK has been introduced in recent months. The data of waste that have originated up to now have already been entered by using one of the modules of the AVK, the module for recording raw waste data.

According to the concept of disentanglement, the data-processing is developed in modules independent of each other.

The modules are:

- Concerning waste flow-surveillance:
  - The module for recording raw waste-data,
  - The module for recording conditioned waste-data,
  - The transport module and
  - The interim storage-module.
- Concerning the quality for final disposal:
  - The module for ensuring that the quality of wastes matches the requirements of the repository (especially in regard to restrictions in radioactivity).
- And modules for documentation as well as for analyzing and handling of data.

Partners involved in using the AVK are the power supply companies, the companies handling the treatment, conditioning, storage and transport as well as the state authorities (9).

TEST AND EXAMINATION SEQUENCE PLAN

In any case, prior to a waste conditioning campaign - by a qualified or unqualified process, for interim storage or final disposal - in cooperation with the waste producer and the conditioner, a document has to be prepared specifying each step in the production of a waste package. This test and examination sequence plan (Prüffolgeplan) gives step-by-step information of the whole procedure. It starts with the collection and documentation of the waste in the nuclear facility via conditioning with private owned or external machinery to interim storage and ends with the final storage. It also includes all necessary transports. Each step is defined, and the organizations responsible for the orderly execution and examination of each step are named.

This test and examination sequence plan has been initiated and developed by our partner company TÜV Hannover situated near the planned Konrad repository. The described method with standardized conditioning procedures and their representation allows conditioning campaigns of different waste producers at different places and by different supervisors to be comparably and independently checked.

These plans are to be drawn up before the start of the conditioning process and they have to be presented to the responsible authority and a delegated expert for approval. After this has been done, the actual work can begin.

After approval of the test and examination sequence plan, the waste treatment itself can take place. The related control steps are indicated in the specific production and quality control steps are indicated in the specific production and quality control specifications for each waste treatment campaign and for all package types containing the waste product. These documents include the critical points and check points in which the individual production and control steps are specified.

When a conditioning campaign is finished, the approval for the final disposal of the waste packages is to be certified in a document which summarizes all documents of transportation, conditioning and testing processes.

Some of the registered data can be used directly or after processing for the waste-flow-control-system. Such data can be collected and - after an internal check - they can be put

into the waste-flow and product-control-system (AVK), (10).

The described state of affairs for the Preliminary Waste Acceptance Requirements is still subject to the plan-approval decision which is still being awaited. With respect to a realization of plannings and determinations, the compulsion and reliability of these requirements are of great importance. Thus, the plan-approval procedure for the Konrad repository should rapidly be continued in order to turn the preliminary waste acceptance requirements into final requirements as soon as possible.

CONCLUSION

Experience in the last two years showed that an extremely centralized system of waste control is not flexible enough. Therefore, it is sensible to delegate the conditioning and interim storage of radioactive waste to the nuclear facilities and the interim storage centers themselves.

According to this new orientation, TÜV Bayern is mainly engaged in the inspection of the conditioning and storage of the waste of five nuclear power plants and some other nuclear waste producing facilities in Bavaria.

Unfortunately, we are still waiting for the Final Storage Criteria for the Konrad Mine. But in line with the "Guideline for the Control of Radioactive Waste with Negligible Heat Generation," our entire work is based naturally on the "Preliminary Final Storage Criteria for Konrad Mine."

We hope that on the basis of the related test and examination sequence plan, the subsequent inspections and the documentation of the conditioned waste packages will fulfill the safety criteria of the Konrad mine.

And we hope that the revised requirements of those storage criteria will not differ too much from the current status to avoid reconditioning.

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