Note:
This is a translation of the statement entitled “Spezifikation der Fa. AREVA NC zu mittelradioaktiven verglasten Abfällen (CSD-B) aus der Wiederaufarbeitung von deutschen LWR-Brennelementen”.
In case of discrepancies between the English translation and the German original, the original shall prevail.

E S K

ESK STATEMENT

Specification by AREVA NC on intermediate level vitrified waste (CSD-B) from the reprocessing of German LWR fuel elements

Contents

1 Request for advice

With letter RS III 3 – 18 042 FRA/6 of 20.01.2010 [1], the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) commissioned the Nuclear Waste Management Commission (ESK) to consult on the AREVA NC specification for the vitrified intermediate level waste Colis Standard des Déchets Boues (CSD-B) from the reprocessing of German LWR fuel elements in La Hague that is to be returned to Germany.

A decision of the BMU on the approval of this specification has to be taken within two years according to the relevant exchange of notes with France being binding under international law.

After the approvals made by the French regulatory authority Autorité de Sûreté Nucléaire (ASN) for the CSD-B specification and the vitrification process [2] and [3], the GNS Gesellschaft für Nuklear-Service mbH (GNS) filed an application with the BMU on 14.01.2010 for granting a so-called approval [4]. This application was supplemented by letter of the GNS dated 09.08.2010 [5] to which AREVA NC letter BU-R/DC/10-359/FLM dated 05.08.2010 [6] is attached, which among others specifies the guaranteed values for U, Pu and the nuclear fuel content in a binding manner.

On the basis of a contract between the German power utilities and AREVA NC of 2005, it is planned to no longer return the assigned activity of the liquid intermediate level secondary waste from reprocessing in the form of bituminised waste, but as vitrified waste (CSD-B). The maximum number of CSD-B is 600 pieces, the technical efforts are, however, to reduce the number to below 300. As a result of this agreement no bituminised waste is to be returned.

The waste product to be assessed is described primarily in the following documents:

- Specification for Standard CSD-B Vitrified Waste Residues Produced at La Hague (in French and English) [7] in addition to [6],

- CSD-B Booklet (in English) [8], and

- Quality Assurance Plan (in French and English) [9].

The objective of the request for advice to the ESK is to answer the question whether the specification submitted meets the requirements to be placed on the waste according to the state of the art in science and technology to ensure safe transport, interim storage over a longer period and the possibility of waste disposal. In particular, the following issues have to be considered:

- specified properties of the packages,
- measures of quality assurance and product control,
- transport and cask concept,
- interim storage concept and resulting requirements, and
- properties relevant for disposal.

The BMU requested the ESK to complete the consultations by the end of January 2011.

2 Consultations

At its 9th meeting on 31.03.2010, the ESK Committee on WASTE CONDITIONING, TRANSPORT AND INTERIM STORAGE (AZ) was informed by the BMU and GNS on the status of the approval procedure for the CSD-B specification and on the time schedule for the return of the CSD-B planned by GNS.

The Chairman of the Committee AZ informed the ESK about this at its 12th meeting on 29.04.2010.

For consultation on the CSD-B specification, the ESK Committee AZ established an ad hoc working group which dealt with the topics stated in the BMU order and determined issues to be consulted on. For this purpose, aspects were identified on which the companies GNS and AREVA NC gave detailed explanations at working group meetings. Moreover, the BfS and the Product Control Group at the FZJ (PKS) as an authorised exert of the BfS were heard on the results of an inspection of the backfitted vitrification line, on relevant aspects of quality assurance and the characterisation of raw waste.

The ad hoc working group addressed the safety issues at two meetings (on 21.05.2010 and 17.08.2010).

On the basis of the issues identified during the discussion of a list of questions, the draft of an ESK statement was prepared at the above meetings of the ad hoc working group that was discussed at the 11th and 12th meeting of the ESK Committee AZ on 22./23.09. and on 20.10.2010, respectively. The draft adopted by the ESK Committee AZ had been submitted to the ESK for discussion at its 15th meeting on 09.12.2010 and was adopted there.

3 Assessment criteria

Criteria for the safety assessment of the aspects identified on behalf of the BMU are

- the RSK safety requirements on the interim storage of low and intermediate level waste in the longer term (as amended on 16.10.2003) [10],
- the requirements of the Federal Office for Radiation Protection (BfS) for the final disposal of radioactive waste (waste acceptance requirements for final disposal; as of December 1995) –Konrad mine [11],
- statement No. 12 of the HLW products working group (AK HAW-Produkte) [12], and
- the Radiation Protection Ordinance and the Atomic Energy Act [13, 14].

Regarding a possible interim storage together with irradiated fuel elements, the Safety Guidelines for Dry Interim Storage of Irradiated Fuel Assemblies in Storage Casks [15] have also been taken into consideration.

4 Manufacturing and specified characteristics of the packages

During the decommissioning of old parts of the UP2 plant in La Hague, the rinse water generates a waste stream that is in principle also suitable for vitrification. Due to the partially high salt content and the changing chemical composition, it is not advisable to mix rinse water with HLW. An intermediate level glass product has therefore been developed that, as a waste package, is referred to in French as “Colis Standard de Déchets – Boues” (CSD-B). Characteristic data on the CSD-B are included in Table I [16]. For comparison, the table also shows exemplary data on a canister with vitrified fission product solution (CSD-V).

Similar to compacted hulls and structural parts of the fuel elements (CSD-C) already assessed in 2005, the proposed new type is described by defining a relatively small number of guaranteed parameters in the CSD-B specification and a larger number of so-called typical values, documented in the CSD-B booklet [8]. Conservatively, the values of the guaranteed parameters are in some cases significantly increased compared to the typical values.

Table I: CSD-B: Activity and radiological properties

Nuclide / element		CSD-B Nominal [1)]	CSD-B Germany [2)]	CSD-B Guaranteed	CSD-V 11458C [4)]
α-activity	[TBq]	0.55	2.5-3.5	6.2	312
β-activity	[TBq]	31	200-280	740	13200
Co-60	[TBq]	0.2	0.001	-	0.007
Sr-90/Y-90	[TBq]	13	35-50	-	6600
Ru-106/Rh-106	[TBq]	0.2	0.05	-	8.8
Cs-137	[TBq]	9.7	110-180	-	5230
Ce-144/Pr-144	[TBq]	0.2	0.2	-	0.2
Eu-154	[TBq]	0.2	0.6-0.8	-	120
Pu-241 (β)	[TBq]	7	3.7-5.5	-	9.1
U	[g]	1900	1500-3000	4500 [3)]	1740
Pu	[g]	22	20-35	110 [3)]	24
Np-237	[g]	1.9	570-950	-	760 [5)]
Am-241	[g]	3.6	7.7-15.4	-	730
Cm-244	[g]	0.02	0.01-0.02	90 [3)]	54
γ local dose rate	[Gy/h]	2.8	30-45	-	614
n local dose rate	[Gy/h]	8.0E-06	-	-	7.7E-03
Heat	[W]	4	25-35	90	1580
Contamination	[Bq/cm²]	< 4	<4	< 4	< 4
Mass	[kg]	450	450	530 [6)]	497

Data (nominal values and guaranteed values) according to specification 300 AQ 061 [7]

1) Nominal values, considered over the project period until 2020

2) Notification of AREVA NC on the characteristics of the CSD-B to be returned to Germany (according to GNS information at the 11th meeting of the ESK Committee on WASTE CONDITIONING, TRANSPORT AND INTERIM STORAGE (AZ)

3) Adoption of the CSD-V guaranteed value [6]

4) VG88, data at the time of loading in the cask CASTOR® HAW28M-015

5) Inventories up to 1,400 g in the same cask [16]

6) Total mass per loading (28 canisters): 14.2 t [6]

4.1 Manufacturing and composition of the CSD-B

Background

At the UP2-400 reprocessing plant fuel elements and solutions with fission products and nuclear fuels were reprocessed from 1966 to 1998 in the following facilities:

1 HADE UNGG: preparation and dissolution of fuel from gas-cooled reactors moderated with graphite,
2 HAO: shearing and dissolving of LWR fuel elements,
3 HADE: 1st PUREX separation cycle, uranium and plutonium extraction,
4 MAU: uranium treatment,
5 MAPu: plutonium treatment,
6 HAPF-SPF: fission product concentration and interim storage.

After completion of reprocessing, the facilities MAU and MAPU for the treatment of liquids had still been in operation until 2001. The entire UP2-400 plant is in the decommissioning phase and is being prepared for dismantling. Before the start of the dismantling activities, all plant parts listed above are rinsed to reduce their contamination. Depending on the contamination and its chemical composition, different solutions and chemicals are used. It is intended to use nitric acid, sodium hydroxide, potassium permanganate solution, oxalic acid, tartaric acid, sodium carbonate and cerium IV in nitric acid solution. After pre-treatment for concentration and the destruction of organic contents, the rinsing solutions loaded with the dissolved activities are vitrified. Details on this have been summarised by GNS in [16], from various sources of AREVA NC.

Due to the origin of the waste from the various parts of the plant and the variety of solutions provided, considerable variations in the chemical and radiological composition are to be expected. AREVA NC specifies the values and ranges for the chemical composition of the rinsing solutions to be vitrified in Table II [16].

The rinsing solutions are stored in three 120 m³ collection tanks with the possibility to mix streams appropriately to optimise the composition for the upcoming vitrification. From the collection tanks, batches of 20 m³ each are transferred into a storage tank, samples are taken, and then they are vitrified.

Although a special glass frit was developed as a matrix, the chemical analysis is of key importance to ensure adequate glass quality. AREVA intends, where appropriate, to mix the rinsing solutions with inactive additives, as e.g. sodium compounds, aluminium nitrate or iron nitrate. This is to achieve a minimum content of cations in the solution being important for glass formation, viscosity and conductivity. This addition of additives is also conducted in the storage tanks.

Table II: Chemical composition of the rinsing solutions for manufacturing of the CSD-B

Element (nitrate)	**Concentration range**			**Element (nitrate)**	**Concentration range**		
	C [1] [g/l]	**Min. [g/l]**	**Max. [g/l]**		**C [1] [g/l]**	**Min. [g/l]**	**Max. [g/l]**
Na	22.2	30 [2]	80	Mo[3]	1.3	0	10
B[3]	0.05	0	5	P[3]	1.1	0	4
Mn	0.03	0	1	S[3]	-	0	1.7
Ce	0.1	0	14	Ba	0.1	0	7
Fe	1.4	0	3	Gd	0.3	0	1
Ni	0.3	0	1	Tc	0.5	-	-
Cr	0.3	0	1	actinides	3.7	0	8
Zr	1.6	0	16	precious metals	0.5	-	-

[1] Rinsing solution for CSD-B production for return to Germany
[2] Reached by additives to ensure glass quality
[3] Calculated as borate, molybdate, phosphate and sulphate

The solution prepared this way can also be mixed with sugar for the retention of potentially volatile radionuclides and better formation of granules for feeding the furnace; it is previously dried in a rotary kiln furnace (calcined) and then passes into the furnace into which the glass frit is also transferred.

The vitrification of high-level waste has been performed within commercial operation at La Hague since 1989. Here, highly active liquid waste is calcined together with solid-containing feed clearing sludge in a first step (i.e. drying and conversion of the nitrates to oxides), then mixed with glass frit and molten to a borosilicate glass product (CSD-V) at 1140°C. Overall, the process for the production of the CSD-B is simplified by not adding feed clearing sludge through separately operating metering wheels as is the case for the CSD-V production. With the exception of the actual furnace, equipment and technology has not been modified compared to the method for the CSD-V production.

The installation of the new so-called Cold Crucible Melter Inductive (CCM), allows for higher processing temperatures, thus enabling the vitrification of waste with “difficult” chemical composition.

The CCM was developed by the Commissariat à l'Energie Atomique (CEA) Marcoule and tested by cold tests at full-scale test platforms. The fundamental difference compared to the old AVM process is the energy input by induction so that the glass is directly heated by the so-called Joule effect and not the melter wall. With this technology, the glass melt temperature reaches 1250°C [19, 20]. In this respect, the process resembles that applied at the Karlsruhe Vitrification Plant (VEK).

The throughput of the furnace is approximately 30 to 40 l of rinsing solution per hour, which means the equivalent of about 25 kg of glass product. To homogenise the product, the melt is also continuously stirred in addition to the bubbling of air.

The wall of the melter is water-cooled (therefore referred to as Cold Crucible Melter) which leads to the formation of a solidified glass film that covers the inside. This allows for higher operating temperatures and causes a lower corrosion rate through the glass melt [21].

The glass melt is periodically poured into a stainless steel canister with dimensions identical with those of the existing canisters with vitrified fission product solutions (CSD-V) and the compacted claddings and structural parts of the fuel elements (CSD-C).

Assessment

Compared to the bitumen products that were originally intended for the return of the raw waste stream "intermediate level waste, liquid", the glass products in the CSD-B contribute to increased safety with regard to storage and disposal due to their material-specific properties. Furthermore, while total activity remains unchanged, the volume of waste to be transported into the Federal Republic of Germany for storage and, finally, for disposal will be reduced. The ESK therefore welcomes the change of waste products. It is to be ensured through appropriate product control that the CSD-B to be transported to Germany only contains waste from the UP2-400 assessed in this Statement (see Chapter 5).

4.2 Radionuclide inventory and its determination

Background

The activity inventory of the rinsing solution to be vitrified is usually considerably below (in some cases by several orders of magnitude) that of the fission product solutions, but a larger degree of chemical and radiological heterogeneity of the waste streams is to be expected. Thus, the inventory cannot be derived from burn-up calculations alone.

According to a report of AREVA NC [18], the following chemical and radiological measurements are performed for characterisation of the solution to be vitrified:

1 ICP-AES (B, Fe, Ni, Zr, Cr, Mo, P, Ru, Mg, Gd, Tc, U, Rh, Te, Sn, Sr, Ba, Nd, Cd, Al, Mn, Ag, Sb, Pd, Y, Eu, La, Pr, Ce, Sm, Pb)
2 Spectrophotometry (Pu, Np)
3 α-spectrometry (α-total, Am-243, Cm-244)
4 β-spectrometry (Sr-90)
5 γ-spectrometry (Co-60, Nb-95, Zr-95, Ru-103, Ru-106, Sb-125, Cs-134, Cs-137, Ce-144, Eu-154, Am-241)
6 Ion chromatography (Na, S)
7 Mass spectrometry (among others, U and Pu vector)

According to AREVA NC, the applied analytical technique also allows to determine the "residual activity" of short-lived nuclides, such as Sb-125, despite the age of the fission product mixtures. Especially this nuclide is considered to be a key nuclide for the calculation of non-measurable nuclides, but after a longer decay time - as in the present case – it is often no longer detectable with routine methods. The U and Pu vectors per batch of 20 cubic meters are also determined individually, while for the CSD-V production, reference is made to the average annual production. According to [17], nuclide activities not directly accessible analytically are determined by correlation to one of the following seven nuclides/elements:

Co-60, Sr-90, Sb-125, Cs-137, Eu-154, Cm-244 and Pu(α).

Assessment

The methods for determining the measurable activity contents, as provided by AREVA NC, are known from similar conditioning processes, correspond to the state of the art and are appropriate. However, the analyses are, compared to the CSD-V packages, considerably more specific for each individual container content to be conditioned, which represents the respective processing batch. Moreover, the contents are strongly influenced by the preceding collection and mixing steps. The procedure was explained and described in various presentations by GNS and AREVA NC [17]. Accordingly, the decontamination steps follow, in particular, chemical requirements. By limiting the decontamination area to the plant components described in Chapter 4.1, inadvertent mixing with other not specified waste streams is excluded, which is essential for the determination of the not directly measurable nuclide activities assessed in the following.

Activities of radionuclides not directly accessible by direct measurement have to be determined by correlation with measured activity contents. These nuclides are combined into a total of 7 nuclide families, which in turn are correlated to one directly measurable nuclide/element each [17]. This procedure complies with the state of the art.

The rationale for the derivation was not examined in detail for each family and each nuclide. This examination is, in addition to other issues, an essential element of the qualification process still to be performed by the BFS. The approach practiced during the ESK consultations, i.e. that GNS provides the required information from AREVA promptly to the extent required, has proved effective and should, according to the ESK, be maintained within the qualification procedure. The qualification process should be rapidly initiated, since it may be possible that the CSD-B to be taken back will include those that will already be produced in the near future.

According to the specification, guaranteed contents of individual nuclides or elements in the CSD-B may be higher than in the CSD-V specification. AREVA NC has entered into an agreement with GNS [6] that only CSD-B are delivered to Germany that comply with all guaranteed values for CSD-V. The ESK welcomes this, since this has the effect that the corresponding assessments from the completed CSD-V process also fully apply to and cover the CSD-B.

4.3 Other package properties

Background

One of the radiological properties of the CSD-B is, in addition to the radionuclide inventory, the dose rate at the surface of the package. According to [16], it is 30 – 45 Gy/h for the gamma dose rate and negligible for the neutron dose rate.
Due to the radiological properties, the value in [16] specified with 25 - 35 W is for thermal output immediately after production.

The construction and the dimensions of the CSD-B correspond to those of vitrified and compacted waste (CSD-V, CSD-C). The nominal weight of CSD-B is 450 kg [16]. In the case of CSD-B, only the lid will be welded on, as is the case for CSD-V, and not the entire head, as is the case for CSD-C.

Assessment

The properties dose rate and thermal output of the CSD-B resulting from the radiological inventory are covered by the corresponding properties of the CSD-V. This also applies to the mass.

The ESK welcomes that construction and dimensions of the CSD-B allow for a uniform handling and using the same handling facilities as for the CSD-V and the CSD-C. For the following waste management steps until disposal, this provides additional opportunities for optimisation and maximum flexibility.

5 Quality assurance measures regarding documentation and product control

Background

The scope of documentation is defined for each CSD-B in specification [7]. Accordingly, in particular, the guaranteed parameters,

- at the time of production:
  - chemical composition of the glass for each discharge,
  - compliance with the conditions of production,
  - total β- and total α-activity,
  - keeping to the cooling time before lid welding, and
- at the time of loading:
  - thermal output,
  - non-fixed β/γ contamination

and other parameters

- at the time of production:
  - nuclide-specific β/γ activity,
  - CSD-B mass and glass mass,
  - masses of the actinides (U, Pu, Np-237, Am-241, Am-243, Cm-245, Cm-244),
  - masses of the metallic particles,
  - isotopic composition of U and Pu,
  - compliance with the welding parameters, and
- at the time of loading:
  - β/γ and neutron dose rate at the surface and at 1 m distance,
  - non-fixed α contamination, and
  - visual inspection.

To ensure the quality of the CSD-B, an internal quality assurance department of AREVA NC, that is independent of the operation of the vitrification plant, performs measures for quality assurance within the scope of its certification according to ISO 9001:2000. In case of a positive test result, AREVA NC issues a Declaration of Conformity for each CSD-B.

In addition, Bureau Veritas reviews, on behalf of the reprocessing customers, the documentation regarding compliance with the properties laid down in the specification [7] properties and carries out inspections in the vitrification plant. A positive test result is documented by Bureau Veritas by a Certificate of Conformity for each CSD-B.

In regard to the product control measures required from the German point of view, GNS will apply for the performance of process qualification at the BfS, develop a corresponding process qualification manual and submit it.

Assessment

The vitrification method and the quality assurance measures for the CSD-B largely correspond to those for the CSD-V. This approach to ensure compliance with all requirements resulting from transport, storage and disposal has proven itself for about 15 years and should, from the point of view of the ESK, also be conducted for the waste stream of the CSD-B.

In contrast to the CSD-V, the raw waste originates from different plant parts and may have significantly differing compositions. This is of special importance with regard to the calculation of the activity inventory of radionuclides that can hardly or not be measured. Therefore, in particular, the origin of the raw waste and mixing in collection tanks is to be documented and taken into account within the qualification process.

From the point of view of the ESK, compliance with the relevant process parameters is to be subjected to recurrent checks by the BfS after completion of the qualification process. This includes auditing by the expert organisation Bureau Veritas working on behalf of the reprocessing customers as well as random inspections of the plant and the procedure by the BfS and its expert organisation consulted. Part of these inspections is also a control of the procedure for mixing the raw waste and the associated scientific and technical justification of, e.g., correlation factors for radionuclides that can hardly or not be measures. The documents required for it, e.g.:

- records on origin, composition and volumes of the raw waste,
- analysis methods and results (including raw data),
- spectra,
- calculation rules and correlations for radionuclides subject to declaration as well as their rationale,

have to be submitted to the BfS, i.e. its expert organisation consulted, for review within the framework of on-site inspections.

The ESK recommends verifying the quality of the product by a 100% documentation review for the CSD-B produced and intended for return shipment to Germany. In addition, random checks should be performed to ensure compliance with the process parameters during the ongoing production as part of regular inspections/audits, as was already for the CSD-V.

Furthermore, the ESK considers it necessary to carry out plausibility checks for individual items prior to the return of the CSD-B to Germany. In this regard, for CSD-V, the comparison of measured and calculated β/γ- and neutron dose rates has been found to work well in practice.

6 Transport and cask concept

Background

According to the explanations of GNS, for reasons of payload optimisation and being able to apply the best operation procedures for the handling, transport and acceptance of the casks of the large container types used so far, large massive metal containers are provided for transport and storage of the CSD-B.

GNS basically envisages known large container types for transport and interim storage that can be handled in the existing loading station at La Hague without conversion, that do not require further cold handling and only require a change of inventory (i.e. reduction) in the approval procedure under traffic law.

Thus, the most likely solution is the use of the CASTOR® HAW28M approved for CSD-V, which is designed to cover the requirements applicable for the CSD-B in every respect. The following considerations are therefore based on this cask. GNS has compiled the product characteristics relevant for the transport and interim storage of the CSD-B in comparison with the CSD-V [17].

As stated in Chapter 4, AREVA NC confirmed by letter to GNS [6] that in addition to the guaranteed values stated in the CSD-B specification [7] for the CSD-B to be returned to Germany, the approval values U_{max}, Pu_{max}, Cm-244, total mass of the fissile material, mass per CSD-B and total mass per loading (14.2 t for CSD-28 B) will not be exceeded.

Accordingly, the values are, in most cases, far below the limits, but in any case will be adhered to. The cask is thus ready for use without modifications for the CSD-B. GNS intends to apply for approval extension for CSD-B in 2011.

Assessment

Since the approval of the CASTOR® HAW28M under traffic law in conjunction with the above-cited limitation obligation of AREVA NC covers the physical and radiological properties of the CSD-B, the safe return of the CSD-B can be guaranteed from the point of view of the ESK.

7 Interim storage facility concept and requirements resulting from it

Background

The concept of interim storage is based on storing the waste in thick-walled, fail-safe casks. The cask provides protection against external hazards.

The interim storage of the CSD-B will take place on the premises of the GNS/BLG in Gorleben in the Gorleben transport cask storage facility (TBL-G).

This building has a usable storage area of 5,000 m² with a storage capacity for 420 transport and storage casks, which are designed both for spent fuel and vitrified waste. The storage building is cooled by natural draught. The interim storage concept presented by GNS provides that the interim storage of the CSD-B in the TBL-G will be performed using the CASTOR® HAW28M type, already approved and in use for the interim storage of the CSD-V, which is also used for the transport of the CSD-B to the interim storage facility.

The casks are positioned under consideration of the casks already stored in the building according to aspects of thermal stresses and radiation protection. The latter takes into account protection objectives both in terms of minimising the dose levels for the personnel and keeping the level at the fence as low as possible to protect the public.

Compared to the casks with CSD-V, the CSD-B will make a comparatively small contribution to dose level and heat input.

Assessment

The ESK has no safety concerns regarding the concept proposed by GNS for interim storage of CSD-B in large containers of the type CASTOR® HAW28M in the TBL-G, since the CSD-B are covered by already licenced and stored CSD-V with regard to all relevant properties and thus all requirements resulting from the guideline [15] are complied with.

8 Repository-relevant characteristics

Background

In Germany, there are no applicable waste acceptance requirements for the disposal of heat-generating waste. In 2009, the HLW products working group (AK HAW-Produkte) therefore proposed repository-relevant properties and parameters for intermediate level glass products (CSD-B) in its statement No. 12 [12].

The list of these properties and parameters shows which data have to be collected and declared during the conditioning process and allows drafting a handbook for process qualification. GNS will submit this handbook to the BfS for review.

The list of repository-relevant properties also contains a list of 60 nuclides that are most likely to be declared for disposal. The activities of a number of these nuclides are to be calculated by correlations based on measured nuclide activities.

On 17.08.2010, GNS presented at a meeting of the ad hoc working group data on the already produced CSD-B and, based on these data, GNS made an assessment on the compliance with the waste acceptance requirements of the Konrad mine [11]. Accordingly, the summation criteria from the analysis of the heat load of the host rock and from the criticality safety analysis are exceeded, whereas the limit of the summation criterion from the accident analysis for the Konrad repository as well as the limits from the analysis of normal operation and anticipated operational occurrences are not exceeded.

Assessment

Due to the properties of the CSD-B, the basic acceptance requirements for disposal of waste products are met. These include, for example, the chemical stability and the absence of free liquids. The fulfilment of other requirements that will result from the acceptance requirements of a repository for heat generating waste can be confirmed by the data collected. These include, among others, information and data on the contamination, the dose rate, the mixing of the waste product and the quality of the CSD-B container.

The data on the activity inventory are obtained, on the one hand, by measurements and, on the other hand, by correlation calculations. An assessment of these methods was made in Section 4.2 of this statement. Also

regarding the evaluation of repository-relevant properties, the ESK stressed the importance of the proposed correlations and their control within the frame of the procedure inspections and audits by the BfS and its authorised experts.
It is not planned to emplace the CSD-B in the Konrad repository. Due to the dimensions and the activity inventories, later disposal together with the CSD-V and the CSD-C is to be provided. Based on the inventory values submitted for an already produced CSD-B, an estimate was performed on how far the limits according to the Konrad acceptance requirements are reached. Compared to an estimate by the GNS, the ESK estimate showed only a slight excess of the incident cumulative value.

Due to the only slightly exceeded Konrad acceptance requirements, the ESK is of the opinion that, based on today's knowledge, the CSD-B considered in this statement can be disposed of in a repository for heat generating waste.

9 Summary

The ESK dealt with the specification for the vitrified intermediate level waste to be returned to Germany within the framework of reprocessing of German LWR fuel elements, based on the requirements defined in Chapter 3 "Assessment criteria".

Compared to the bitumen products that were originally intended for the return of the raw waste stream "intermediate level waste, liquid", the glass products in the CSD-B contribute to increased safety with regard to storage and disposal due to their material-specific properties. Furthermore, constant total activity provided, the volume of waste to be transported into the Federal Republic of Germany for storage and, finally, for disposal will be reduced. The ESK therefore welcomes the change of waste products. It is to be ensured through appropriate product control that the CSD-B to be transported to Germany only contains waste from the UP2-400 assessed in this Statement.

The methods for determining the activity contents are known from similar conditioning processes; they correspond to the state of the art and are appropriate.

Activities of radionuclides not directly accessible by direct measurement have to be determined by correlation based on measured activity contents. In this respect, special attention is to be paid to the determination of radionuclide inventories to be performed as part of the product control.

The ESK welcomes that construction and dimensions of the CSD-B allow for a uniform handling and using the same handling facilities as for the CSD-V and the CSD-C. This has logistic and safety-related advantages for storage and disposal.
The quality assurance measures for the CSD-B largely correspond to those for the CSD-V. This approach to ensure compliance with all requirements resulting from transport, storage and disposal has proven itself for about 15 years and should, from the point of view of the ESK, also be introduced for the waste stream of the CSD-B.

In contrast to the CSD-V, the raw waste originates from different plant parts and may have significantly differing compositions. Therefore, in particular, the origin of the raw waste and their mixing in collection tanks is to be documented and taken into account within the qualification process and product control.

From the point of view of the ESK, after completion of the qualification process, continuous compliance with the relevant process parameters is to be verified as part of the documentation review and of random inspections by the BfS and its expert organisation consulted.

Since the approval of the CASTOR® HAW28M under traffic law in conjunction with the above-cited limitation obligation of AREVA NC covers the physical and radiological properties of the CSD-B, the safe return of the CSD-B can be guaranteed from the point of view of the ESK.

The ESK has no safety concerns regarding the concept proposed by GNS for interim storage of CSD-B in large containers of the type CASTOR® HAW28M in the TBL-G, since the CSD-B are covered by already licenced and stored CSD-V with regard to all relevant properties.

The ESK is of the opinion that, based on today's knowledge, the CSD-B considered in this statement can be disposed of in a repository for heat generating waste.

The ESK concludes that, taking into account the requirements formulated in this statement, the CSD-B with vitrified rinsing solutions from reprocessing plants in France comply with the requirements that must be met for the waste packages in accordance with the state of the art in science and technology to ensure safe transport, longer-term storage and safe disposal.

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