Note:
This is a translation of the statement entitled “ESK-Stresstest für Anlagen und Einrichtungen der Ver- und Entsorgung in Deutschland Teil 2: Lager für schwach- und mittelradioaktive Abfälle, stationäre Einrichtungen zur Konditionierung schwach- und mittelradioaktiver Abfälle, Endlager für radioaktive Abfälle”.
In case of discrepancies between the English translation and the German original, the original shall prevail.

E S K

STATEMENT of the Nuclear Waste Management Commission (ESK)

ESK stress test for nuclear fuel cycle facilities in Germany*

Part 2:
Storage facilities for low- and intermediate-level radioactive waste, stationary facilities for the conditioning of low- and intermediate-level radioactive waste, disposal facilities for radioactive waste

STATEMENT

Revised version of 18.10.2013

Compared to the original version of 11.07.2013, an incorrect statement was corrected in Chapter 5.6, second last bullet point: company Eckert & Ziegler Nuclitec GmbH does not operate a storage facility at the Braunschweig site.

*Translator’s note: In the German original, the terms "Anlage" and "Einrichtung" are used. Both terms are translated by "facility" since, in this Statement, reference is always made to a facility of the nuclear fuel cycle (NFCF).

Contents

1 Background information and request for advice

The earthquake off the Japanese coast on 11.03.2011 and the subsequent flooding caused by a tsunami triggered a nuclear disaster at the Fukushima site. Although the initiating events of the nuclear disaster in Japan, especially the magnitude of the earthquake and the height of the tidal wave, are not directly applicable to conditions in Europe and Germany, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) considers it necessary, as a consequence of these events, to not only perform a robustness assessment for German nuclear power plants, but also a stress test for spent fuel and radioactive waste management facilities in Germany.

Against this background, the BMU commissioned the NUCLEAR WASTE MANAGEMENT COMMISSION (ESK) by letters dated 22.06.2011 [1] and 18.07.2011 [2] to develop appropriate review concepts for facilities in operation or under construction for the treatment, storage and disposal of spent fuel, heat-generating and other types of radioactive waste and for the plants for uranium enrichment in Gronau and fuel fabrication in Lingen. These types of facilities are all facilities serving the purpose of fuel supply or waste management. There are also other facilities in which radioactive materials are handled, e.g. for research or the production of isotopes. These facilities are not included in the request for advice to the ESK and have therefore not been considered in the statements of the ESK on the stress test.

For a better structuring of its approach, the ESK applied an internal classification of the facilities according to different categories. With its statement of 14.03.2013 [3], the ESK already assessed the robustness of nuclear fuel supply facilities, storage facilities for spent fuel and heat-generating radioactive waste and facilities for the treatment of spent fuel against beyond design basis events. In this second part, the ESK assesses the robustness of storage facilities and conditioning facilities for low- and intermediate-level radioactive waste and disposal facilities for radioactive waste (Asse II mine, Morsleben repository for radioactive waste (ERAM) and the Konrad mine repository).

In order to ensure separation of functions between the REACTOR SAFETY COMMISSION (RSK) and the ESK, it was determined in a co-ordination meeting with the BMU on 31.05.2012 that radioactive substances from operational use in nuclear power plants will be considered as soon as they are put into long-term storage within the nuclear power plant or are processed for it (raw waste, conditioned waste).

Issues related to the physical protection of facilities are not considered in the framework of this review (in this regard, physical protection is to be understood as active and passive measures to prevent impacts from interference by third parties). The impacts of chemotoxic substance releases are not considered as part of this request for advice either.

In contrast to installations licensed under the Atomic Energy Act (AtG), the facilities considered in Part 2 of the ESK statement on the stress test generally have a handling licence according to the Radiation Protection Ordinance (StrlSchV) [4]. The term “installation” is not used in the StrlSchV, “design requirements” are not formulated therein.

*Translator’s note: i.e. “installation” in terms of the Atomic Energy Act

This stress test does not refer to the design requirements reviewed as part of the licensing procedures and the designs and protective measures derived from it. Instead, with this statement, the ESK assesses the robustness of facilities against impacts on the basis of the impacts of damage patterns under conservative boundary conditions. In this way, it is investigated how the facilities behave under extreme loads and whether a sudden rise regarding the radiological consequences outside the facility (cliff edge effect) due to the failure of components or measures is foreseeable.

2 Consultations

Requests for advice [1] and [2] were presented to the ESK at its 20th ESK meeting on 25.08.2011. The ESK has then set up the ad hoc working group AG SÜ (*Arbeitsgruppe SICHERHEITSÜBERPRÜFUNG - AG SÜ*) which initially agreed on the approach at its eleven (one- or two-day) meetings from September 2011 to May 2013, then determined the facilities to be considered in the ESK stress test, generated questions and requested information about the different facilities via the competent supervisory and licensing authorities. On the basis of the written responses of the operators [17-38] and explanations of the competent *Land* authorities, the AG SÜ prepared a draft statement on the stress test for storage facilities and stationary facilities for the conditioning of low- and intermediate-level radioactive waste and disposal facilities for radioactive waste, which was submitted to the ESK for further consideration and adoption at its 34th meeting on 11.07.2013. The competent *Land* authorities were informed about the meetings and topics consulted on by the AG SÜ and were given the opportunity to participate in the meetings and to respond to issues of concern orally or in writing.

3 General approach

Compared to the facilities considered in Part 1 of the ESK stress test [3], both the number and the diversity of the facilities in which low- and intermediate-level radioactive waste is handled and which are to be considered in Part 2 of the stress test are significantly larger. The techniques used (e.g. for storage, handling and conditioning of radioactive waste) vary according to the type and quantity of the radioactive waste produced. The ESK considers the release potential – and thus, in particular, the licensed radioactive inventory – to be a central element for assessing the robustness of these facilities.

Facilities whose radioactive inventory is so small that only very low releases resulting from beyond design hazards are possible in the stress case do not have to be considered in the stress test because serious impacts are not possible due to their low inventory. This means that – with regard to the subject matter of the stress test – their hazard potential is low. For such facilities, the ESK has chosen the so-called cut-off criteria in accordance with the Radiation Protection Ordinance (StrlSchV) (see Chapter 4).

Facilities whose licensed radioactive inventories exceed these cut-off criteria were listed (see Annex) and dealt with in the stress test, Part 2. For this purpose, the ESK formulated questions on these facilities and used the answers as a basis for their assessment. However, due to their large number, it has not been possible to consider and assess all the facilities individually. Contrary to Part 1 of the statement, the potential impacts of previously defined beyond design load cases were therefore not determined and assessed for each facility, but a generic approach was chosen. For this purpose, the ESK defined types of damage patterns that cover, with only a few exceptions, the severe impacts on the facilities to be assessed and the waste packages contained in them. For facilities that might not be covered by these damage patterns and/or the specified boundary conditions for determining the impacts, the ESK recommends a review by the competent supervisory and licensing authorities.

4 Approach in particular

The storage and conditioning facilities for radioactive waste considered here are facilities with very different inventories of radioactive material in different conditioning states. The ESK has based the lower cut-off criterion for the facilities actually to be considered in the stress test on the provisions of the Radiation Protection Ordinance (StrlSchV) [4] and includes all facilities in the stress test whose licensed inventory exceeds 10^7 times the exemption levels (total activity pursuant to Appendix III, Table 1, Column 2 StrlSchV) for unsealed radioactive material or 10^{10} times the exemption levels for sealed radioactive material. Facilities where radioactive substances below these multiples of the exemption levels are handled are, pursuant to § 53 StrlSchV, not obliged to take preparatory measures for damage fighting otherwise required in case of safety-relevant events due to their limited hazard potential. This cut-off criterion excludes facilities from the stress test where no potential for severe radiological consequences in the environment is to be assumed.

By letter dated 20.09.2011 [5], a first query was made by the BMU at the relevant supervisory authorities of the *Länder* regarding the existing facilities of the nuclear fuel cycle whose licensed inventories exceed the previously defined multiples of the exemption levels. With further letter of the BMU of June 2012, a list of questions [6-16] was sent to the supervisory authorities of the *Länder* to request in-depth information on the storage facilities for low- and intermediate-level radioactive waste and the conditioning facilities for low- and intermediate-level radioactive waste. Based on the answers of the supervisory authorities of the *Länder* [17-38], the facilities to be considered in the stress test were determined as shown in the table in Annex 1. The written answers of the operators, the statements of the competent supervisory authorities [17-38] and oral explanations of some supervisory authorities in the meetings of the AG SÜ served as a basis for discussions and assessments conducted by the ESK. The ESK reviewed the completeness of the facilities listed in Annex 1 and thus to be considered in the stress test, and clarified related individual questions in dialogue with the competent *Land* authority.

Due to the large number and diversity of facilities to be considered, the assessment of the robustness is based – contrary to that of the facilities in the stress test, Part 1 - on damage pattern types, taking into account the relevant scenarios, and on generic radionuclide inventories. However, the load cases defined for the stress test, Part 1 (earthquakes, flooding, heavy rain, other weather-related events, loss of electrical power, internal fires, external fires, aircraft crashes and blast waves) were considered in the development of damage pattern types. External experts supported the ESK in the modelling of these damage patterns, the determination of generic radionuclide inventories for different categories of storage and conditioning facilities and the calculation of the dose rates in the vicinity of the facilities resulting for the different damage patterns.

The damage pattern types are also applicable to the above-ground handling of radioactive waste in disposal facilities for low- and intermediate-level radioactive waste.

The ESK discussed and assessed the robustness of the facilities to be considered here on the basis of potential releases determined for the damage pattern types as well as of the assessment criterion of values being below the intervention reference levels for major disaster control measures (see Chapter 5.2). It was also examined whether cliff edge effects might occur. A "cliff edge effect" occurs if a sudden rise regarding the radiological consequences outside the facility is registered that is due to the failure of components or measures caused by a load beyond the design of the facility.

5 Storage facilities and conditioning facilities for low- and intermediate-level waste

5.1 Questions in the ESK stress test

In the following, the list of questions of the ESK of 06.06.2012 [6-16] is explained, which was sent to the nuclear licensing and supervisory authorities of the *Länder* by the BMU. The list comprises three parts that include the relevant facilities individually for each *Land* to show the connections. Parts 1 and 3 were not relevant for all *Länder* since not all facility types exist in the respective *Land*.

Part 1 served to verify and complete the list of the facilities to be considered in the stress test. For this purpose, inquiries were made on the licensing situation and on licensed inventories for the facilities specified.

Part 2 refers to all facilities that are to be considered in the stress test due to the licensed inventories. For these, provision of the following information was requested:

“1. The related licence of the storage/conditioning facility including all officially confirmed amendments, restrictions or extensions that are currently valid.
2. Information about the permissible inventory of the facility according to the matrix in Annex 1.
3. Are, due to the type of the facility or the technical processes, the following radionuclides of the group "Other nuclides" in column VI of the table relating to question 1 (see matrix in Annex 1) limited as regards their inventories: cobalt-60, strontium-90, cesium-137, cesium-134, alpha emitters (uranium-235/238, plutonium-239/240, americium-241, radium-226, thorium-232)?

4. If the waste is provided/stored /conditioned in buildings, what are the heights of the buildings inside (interior height)?
5. Is radioactive waste in the facility placed in a pit? If so, please indicate the size of the pit (length, width, depth)."

Part 3: In order to differentiate the tasks in the stress test for nuclear fuel cycle facilities from the stress test conducted by the RSK for nuclear power plants, it was determined in a co-ordination meeting of the BMU, the RSK Chairman and the ESK Chairman on 31.05.2012, among other things, that as soon as radioactive substances from operational use in a nuclear power plant are put into long-term storage or are processed for it (e.g. as raw waste or as conditioned waste), they fall within the area of tasks of the ESK. Thus, Part 3 of the list of questions serves to clarify the extent to which rooms and areas that are used within nuclear power plants or on the premises of nuclear power plants for storage/keeping ready of raw waste, partially or fully conditioned waste or for conditioning of waste with mobile or stationary conditioning installations may also have to be be considered in the stress test of the ESK. For this purpose, the following questions were formulated:

"Are rooms/areas within the nuclear power plants or at the site outside the NPPs used for storage/keeping ready of raw waste, partially or fully conditioned waste or for conditioning? If yes, please provide information on the following:

1. The related licence parts including all officially confirmed amendments, restrictions or extensions that are currently valid in which the use of the rooms is regulated.

2. Information on the following questions:
   a) Within which buildings/where on the site are these rooms/areas located?
   b) What protective measures (e.g. maintenance of negative pressure, ventilation systems) are implemented there?
   c) What are the dimensions of the rooms or, where existing, pits in which waste is stored/kept ready?
   d) What is the maximum permissible inventory to be stored/kept ready in the individual room? (please provide details using Annexes 1 and 2)
   e) Which inventory is permitted to be handled in the individual room for the purpose of conditioning? What conditioning techniques are used? Is the conditioning installation mobile or stationary?"

Based on the query, the facilities listed in Annex 1 could be identified as those that are to be included in the stress test. The storage facilities listed there are divided according to

- central storage facilities,
- on-site storage facilities,
- storage facilities in decommissioned NPPs,
- storage facilities in research institutions,
- storage facilities of the nuclear industry,
- *Land* collecting facilities, and
- storage facilities and facilities for conditioning within the licensing scope of NPPs.

Another category in Annex 1 comprises the facilities for conditioning of low- and intermediate-level radioactive waste for own needs and for third parties.

Besides the name of the facility, the site with the respective *Land* is specified in Annex 1. In addition, information is included on the possible inventory.

5.2 Assessment criteria

To assess the potential releases determined on the basis of damage pattern types, the dose criterion was applied as reference level for the initiation of major disaster control measures in the form of the measure "evacuation". For this measure, the intervention reference level is a 100 mSv effective dose within seven days according to the "Radiological Fundamentals for Decisions on Measures for the Protection of the Population against Accidental Releases of Radionuclides (*Radiologische Grundlagen für Entscheidungen über Maßnahmen zum Schutz der Bevölkerung bei unfallbedingten Freisetzungen von Radionukliden*) [41]. In this context, the following exposure pathways are to be considered [41, 43] (see also Chapter 5.4.4.2):

- exposure due to intake of radioactive substances with respiratory air (inhalation),
- exposure due to gamma radiation from the plume (gamma submersion), and
- exposure due to gamma radiation from the radioactive substances deposited on the ground within seven days (ground radiation).

Continuous stay in the open for seven days is to be postulated.

Other exposure pathways (beta submersion and direct radiation) can either be neglected because of their minor relevance or are less urgent (ingestion) since ingestion can be prevented through early warning against the consumption of freshly harvested food as well as fresh milk from the affected area.

The radiation exposure is to be determined primarily for the nearest residential buildings or workplaces and for the groups of infants and adults. This does not apply to workplaces on the premises of the facility considered or to workplaces that are subject to a joint emergency protection regime with the facility considered.

The dose criterion of 100 mSv within seven days, which is usually referred to for the assessment of beyond design basis events, differs significantly from the accident planning value according to § 49 and 50 of the the Radiation Protection Ordinance (StrlSchV) to be used for design basis accidents. The accident planning value for the effective dose is 50 mSv and relates, according to the incident calculation bases (*Störfallberechnungsgrundlagen*) applicable in this case [48], to the sum of the dose received over a lifetime of 70 years, including beta submersion and ingestion. Here, continuous stay in the open is to be postulated as well as the consumption of foodstuffs solely from the most unfavourable receiving point. Thus, for the same amount of a radionuclide released, a considerably higher dose is calculated according to the incident calculation bases [48] than according to the calculation bases [41, 43] to be referred to for intervention reference levels for disaster control measures. Depending on the radionuclide, in particular depending on the half life and the importance of the ingestion pathway, a dose calculated according to the incident calculation bases may be higher up to two orders of magnitude than a dose determined according to the basic recommendations for disaster control. If the dose criterion of 100 mSv is reached in seven days, so this usually means a significant excess of the accident planning value and is therefore suitable as a criterion for the stress test.

A different criterion is used here for flooding because a radiation exposure due to radionuclides dissolved in surface water cannot be assessed by means of the intervention reference levels for disaster control measures, which relate exclusively to releases into the ambient air. In this case, the radiation exposure is determined analogous to the general administrative provision on § 47 of the Radiation Protection Ordinance (StrlSchV) [44]. Here, there is a release of radionuclides into flowing water, which may lead to a radiation exposure from drinking water production, use for irrigation of agricultural land, stay on contaminated shore sediment, etc. (see Chapter 5.4.4.2).

For the scenario of a tidal wave, the possibility that packages are swept away beyond the boundaries of the facility site is considered. At the same time, occurrence of a tidal wave at a specific site has to be possible.

For the event of flooding it is considered, in addition to the dose criterion, whether the loss of a medium may lead to a relevant release of radioactive material in terms of the stress test. This can initially be done generically for the various types of facilities. If a medium loss may generally lead to a relevant release of radioactive material in terms of the stress test, this is to be examined specifically for the facility.

5.3 Description of the storage facilities and conditioning facilities for low- and intermediate-level waste

The facilities for storage or conditioning of low- and intermediate-level radioactive waste to be considered here have a licence for handling radioactive material pursuant to § 7 of the Radiation Protection Ordinance (StrlSchV) or have been considered within the framework of a licence pursuant to § 7 of the Atomic Energy Act (AtG). Some facilities with handling licence pursuant to § 9 AtG have also been considered.

- **Storage facilities for low- and intermediate-level radioactive waste**

The waste stored originates from different applications, in particular from the operation and decommissioning of nuclear facilities as well as from other use of radioactive material, for example in industry, medicine and research. Thus, they are significantly different regarding the nuclide vector and the radioactive inventory of the waste packages. Moreover, a distinction has to be made between the different conditioning states (unconditioned waste, partially conditioned waste and conditioned waste) as well as between combustible and non-combustible waste.

The waste is either stored

- in central storage facilities for waste from nuclear facilities,
- in decentralised storage facilities at the sites of nuclear facilities,
- within the nuclear facilities,
- in public *Land* collecting facilities, or
- in private collecting facilities.

The confinement of radioactive material is achieved by confinement in waste containers and for certain waste products by incorporating them into a waste matrix. For the storage facilities to be considered here, the waste is stored in buildings. In some cases, these buildings may have a special barrier function, i.e. if they have a ventilation system with retention devices. The use of mainly passive systems for the confinement of radioactive material is therefore an essential feature of the facility concept regarding the storage of radioactive waste.

Relevant impacts of incidents may therefore particularly occur if they lead to the destruction of the containers and the waste matrix so that radioactive material will be released into the environment. The maximum possible impacts on the environment are dependent on the existing radioactive inventory, the maximum inventory stored per container, the number of packages affected in an incident, and the release scenarios.

- **Conditioning facilities for low- and intermediate-level radioactive waste**

In the conditioning facilities, the waste is brought into a condition suitable for a longer storage or for disposal. The methods applied for it are, for example, crushing, drying, burning and further treatment of incineration residues, supercompaction or concreting.

During conditioning, only a few waste packages are handled. Containers and their inventories are only processed individually. During processing, the radioactive waste generally exists in the form of unsealed radioactive material. Contrary to the mere storage of waste packages, a loss of medium (in particular power supply) is to be considered since, for example, an active ventilation to limit releases of radioactive material into the environment during the treatment process or the handling of raw waste in the conditioning facility may depend on the supply of a medium. Moreover, storage or keeping ready takes place in a manner comparable to the situation in the storage facilities.

Both the storage and conditioning facilities for low- and intermediate-level radioactive waste have characteristics in common with respect to potential releases of radioactive material during beyond design basis impacts. It is therefore appropriate not to consider each facility of Annex 1 separately but to refer to damage pattern types as a basis and to consider the radiological consequences of these damage patterns generically.

5.4 Damage pattern types

Contrary to the facilities considered in Part 1 of the statement, the ESK did not assess the facilities to be considered here individually but adopted a generic approach. As a basis for further steps, the ESK defined damage pattern types that cover all types of severe impacts on the facilities to be examined and the waste packages contained in them. In the stress test, these damage pattern types are postulated and the robustness of the facilities against these damage patterns is assessed. The damage pattern types can basically be divided according to three types of impacts:

- thermal impacts due to a longer lasting fire,
- mechanical impacts on waste packages, with a distinction being made between a locally concentrated and a planar impact with different energy input, and
- impacts of water from a tidal wave or flooding where the loss of a medium, such as power supply, is also to be considered.

In the following, these damage patterns are specified and described by means of scenarios. On this basis, it is then assessed in further steps how many packages may be concerned, which releases of radioactive material are to be postulated and what radiological consequences these releases may have.

5.4.1 Description of damage pattern types

- **Thermal impact**

To provide full coverage, a scenario is used where the actual fire load is due to the postulated event. A large load input is possible if in an aircraft crash fuel leaks out and burns in the area of the radioactive waste.

In the stress test, the crash of an aircraft with an impact load-time diagram, an impact area and an impact angle according to the Safety Requirements for Nuclear Power Plants [42] was referred to as a basis. Accordingly, the mass of the fuel is 5,000 kg. A fire with a duration of one hour and a temperature of 600°C is postulated until the fuel is burnt down.

- **Locally concentrated mechanical impact**

The impact of an engine shaft on packages resulting from an aircraft crash is referred to as locally concentrated mechanical impact. The impact load-time diagram for an aircraft crash is defined in the Safety Requirements for Nuclear Power Plants [42]. Boundary conditions for the aircraft impact are a speed of 215 m/s, a mass of 20 Mg, an impact area of 7 m² and an impact angle defined as normal to the tangential plane at the point of impact. For the impact on the facilities dealt with here, in particular the impact of an engine shaft with a mass of 1.7 Mg is the main mechanical load. For the determination of the consequences, an impact area of 1.5 m² is defined and the maximum number of packages involved determined.

- **Planar mechanical impact**

The collapse of a roof truss is considered as a planar mechanical impact. Mass and height are to be defined such that other events, such as dropping of a load moved by a crane system, are covered. Since the roof truss drops from the height of the building roof, maximum possible heights at which packages are handled are covered. Dropping of packages during handling is subject to standard accident analyses so that consideration within the framework of the stress test is not required for these cases.

The mass of the roof truss considered in the stress test is 20 Mg. This corresponds, for example, to the mass of a cube with a length of 25 m, a height of 0.8 m a width of 0.4 m and a concrete density of 2.4 Mg/m^3. Such dimensions are typical for large storage halls. The drop height is postulated to be 10 m. Some storage halls for radioactive waste exceed such a height. If, however, it is taken into account that not the height of the free fall down to the bottom plate is decisive but down to the respective waste package, the height of 10 m can be regarded as a typical value for a high hall.

- **Flooding**

For the event of flooding it is postulated that there is water up to a height of 2 m in the storage area of the packages for ten days and then runs off. In this way, radioactive substances dissolved and leaked from the packages get into surface water.

In addition, it is to be considered for the individual facility whether the loss of a medium caused by the flooding, e.g. the loss of power, may lead to massive releases of radioactive material.

- **Tidal wave**

For the scenario of a tidal wave it is to be examined whether packages with radioactive waste can be swept away from their storage location and from the facility site. In addition to this general possibility, it is also a condition when addressing specific facilities that a tidal wave is possible at the respective site, for example after failure of water dams and barriers located in the upper stream of relevant flowing waters and receiving waters.

5.4.2 Derivation of package inventory types

For the radiological assessments, inventories of radioactive material of the package types to be considered are to be defined and also a nuclide vector. In this regard, a distinction is made between the following types of facilities:

- central storage facilities,
- on-site storage facilities,
- storage facilities in decommissioned NPPs,
- storage facilities in research institutions,
- storage facilities of the nuclear industry,
- *Land* collecting facilities,
- storage facilities and facilities for conditioning within the licensing scope of NPPs, and
- facilities for conditioning of low- and intermediate-level radioactive waste (for own needs and for third parties).

With the postulated inventories, the nuclide vectors should provide coverage. This means that this requirement has to be fulfilled on average over the number of packages involved and considered. In addition, the nuclide vectors should be suitable and sufficiently conservative with regard to the dose calculations performed here. Therefore, radionuclides being relevant with regard to inhalation and external gamma radiation over a short period of time have particular significance.

Within this generic approach, facilities in which low- and intermediate-level radioactive waste from nuclear power plants and research reactors is stored or conditioned can be considered jointly because they have similar nuclide vectors. This concerns the following of the aforementioned facilities, which will be referred to as Group I:

- central storage facilities,
- on-site storage facilities,
- storage facilities in decommissioned NPPs,
- storage facilities in research institutions (as far as they basically contain waste from reactors),
- storage facilities and facilities for conditioning within the licensing scope of NPPs, and
- facilities for conditioning of low- and intermediate-level radioactive waste (for own needs and for third parties) (as far as they basically contain waste from reactors).

By contrast, radioactive waste from research institutions, from isotope production and in *Land* collecting facilities may have explicitly other and also very different nuclide vectors. In the generic approach, a common nuclide vector is also defined for this radioactive waste, which provides coverage with respect to the dose criterion and package inventories existing in practice. This concerns the following of the above facilities, which will be referred to as Group II:

- storage facilities in research institutions (as far as they basically do not contain waste from reactors),
- storage facilities of the nuclear industry,

- *Land* collecting facilities, and
- facilities for conditioning of low- and intermediate-level radioactive waste (for own needs and for third parties) (as far as they basically do not contain waste from reactors).

5.4.2.1 Waste in storage facilities from operation, decommissioning and dismantling of nuclear power plants and research reactors

Much of the existing radioactive waste originates from the operation, decommissioning and dismantling of nuclear power plants and research reactors. For this waste, Co-60 and Cs-137 are defined as reference nuclides since they substantially contribute to the dose due to their radiological properties and their half-lives. To provide coverage, the total activity of packages is postulated to be 70 % as Co-60 and 30 % as Cs-37. Such a ratio between Co-60 and Cs-37 can be regarded as typical for waste with high Co-60 content. The conservatism is mainly due to the fact that only this ratio is postulated and other radionuclides typically represented, such as iron and nickel isotopes, that contribute little to the dose with the defined dose criterion, are not considered.

A distinction is made between the types of packages stated in Table 1. The medium to high activity inventories listed there are based on experience as well as the evaluation of the information on the facilities being relevant here collected through the list of questions sent to the *Länder*. For a large number of packages affected by an impact, medium activity inventories can at least partly be referred to for the assessment, otherwise the high activity inventories, to provide coverage.

The studies show that the impacts with high release potential can only affect a limited number of packages simultaneously for the damage pattern types considered here. Therefore, it is not necessary to define a storage facility occupancy with different package types providing coverage.

The number of simultaneously affected packages is small compared to the storage volume of a major storage facility. For example, the average storage capacity of the on-site storage facilities is about 1,000 m³ with a maximum of about 4,000 m³.

5.4.2.2 Radioactive waste in *Land* collecting facilities, from isotope production and from nuclear industry

The radioactive waste stored in the *Land* collecting facilities has a large spectrum of radionuclides since they may originate from very different areas of application. The spectrum is therefore comparable to that of waste storage facilities of the isotope production in which not only operational waste but also radionuclides taken back are stored. Thus, there is no need for a separate consideration of waste storage facilities of the isotope production. The spectrum of the waste storage facilities of the nuclear industry is also covered by this since here, the waste stored mainly originates from fuel fabrication.

Due to the higher release fractions in case of impacts on 200 l drums compared to more resistant package types, an impact on 200-l drums is postulated, which provides coverage. With a postulated volume of stored waste of 2,000 m³, which is a relatively large volume, a total of 10,000 packages would be stored. As further studies show, further differentiation of the possible occupancy is not required since the damage pattern types with a high release potential considered here only affect a limited number of packages at the same time.

Based on the *Länder* query on the respective facilities, an activity inventory of 4E11 Bq is postulated for a single 200 l drum. 1E8 Bq are postulated as a medium activity inventory. As radiologically relevant radionuclides in typical waste of the *Land* collecting facilities, Co-60 and Ra-226 are considered here. To provide coverage, the expected total activity of packages is postulated to be 90 % as Co-60 and 10 % as Ra-226. The waste contains Co-60 relatively often, especially if it originates from the operation of research reactors (the major *Land* collecting facilities are affiliated to such research centres).

Co-60 is relevant with respect to the external exposure within seven days, whereas Ra-226 contributes to the inhalation dose. The Ra-226 contained in the waste of the *Land* collecting facilities originates from disused phosphors. The Ra-226 inventory of a single package with a high inventory postulated here amounts to 4E10 Bq, which corresponds to about 1 g of radium. The 200 l drums in *Land* collecting facilities generally have Ra-226 inventories of up to some 10 mg. Since here, Ra-226 is also representative for other alpha emitters, which partly also have dose coefficients for inhalation being higher by one order of magnitude (e.g. Am-241), this approach is justified.

5.4.2.3 Radioactive waste in conditioning facilities

Depending on the origin of the waste, the same nuclide vectors are used for conditioning facilities as for the storage facilities. In a conditioning facility, there is an area where raw waste is kept ready for treatment, the facility for conditioning with its inventory, as well as an area where conditioned waste is stored until transfer to a storage facility.

Compared to a storage facility of standard size, there is a rather low radioactive inventory, corresponding to a few packages with conditioned waste. Since the studies on radiation exposure within the stress test are based on loads due to the damage pattern types not related to conditioned waste, the conditioning facilities are covered by considerations of the respective storage facilities in the previous two chapters.

In addition to the storage areas for unconditioned and conditioned waste, for a conditioning facility, the conditioning area itself is also to be considered. In the conditioning areas, release of radioactive material into the air may occur if, for example, maintenance of negative pressure fails and radionuclides from waste unsealed during conditioning would no longer pass through filters. Due to the low inventory in the conditioning areas, however, such releases are also covered by the analyses on those damage patterns which in storage facilities result in releases into the air.

5.4.2.4 Summary of package types, activity inventories and nuclide vectors

According to the above considerations, there are two types of facilities that need to be distinguished for further studies. The respective types of packages, activity inventories and nuclide vectors are summarised in Table 1.

Table 1: Package types, activity inventories and nuclide vectors

Package types	Medium activity inventory [Bq]	High activity inventory [Bq]	Nuclide vector
Storage facilities for low- and intermediate-level waste from operation, decommissioning and dismantling of nuclear power plants and research reactors			
Cast iron container	1E12	1E15	Co-60: 0.7 Cs-137: 0.3
Concrete container	1E12[1]	1E12	
Konrad IV container	5E9	1E12	
20‘ container	1E9	4E11	
200 l drum	1E8	4E10	
Land collecting facilities and storage facilities for waste from isotope production			
200 l drum	1E8	4E11	Co-60: 0.9 Ra-226: 0.1

5.4.3 Assessment of potential releases on the basis of the derived release fractions of the different package types

Based on the package types with their nuclide compositions determined and listed in Table 1 and the potential maximum damage impacts for the damage pattern types considered, the number of packages affected by beyond design basis events and the resulting activity releases are determined separately for facilities of Group I and Group II.

The activity inventories of waste packages located in storage facilities within nuclear power plants are generally not limited by regulations but, in practice, there are limitations for reasons of manageability and transportability of the waste packages. However, the level of the potential activity inventories is not quantifiable. Some of these storage facilities are located inside the nuclear power plant building which is designed against external hazards so that the building structures of the actual storage areas will not completely be destroyed even in case of impacts considered under the specified model assumptions. There are, however, also storage facilities in the open air and in buildings not designed against external hazards. In the damage patterns, retention of released radionuclides by building structures is not postulated. A special consideration of storage facilities that are covered by the operating licences of nuclear power plants does not take place here because releases from similar packages and with comparable radioactive inventories are covered by the consideration of other storage facility for low- and intermediate-level radioactive waste.

[1] According to [49], the medium and the high activity inventory are identical for concrete containers.

The following damage pattern types are postulated as beyond design basis events, regardless of the probability of occurrence:

- thermal impact (model assumption: fire of 5,000 kg kerosene),
- locally concentrated mechanical impact (model assumption: impact of an engine shaft of 1.7 Mg with a speed of 215 m/s),
- planar mechanical impact (model assumption: collapse of a roof truss of 20 Mg from a height of 10 m),
- longer lasting flooding (model assumption: flooding of the facility up to a height of 2 m for ten days), and
- tidal wave (model assumption: packages are swept away from the facility into the surrounding area).

For each damage pattern type, the possible number of packages concerned in the respective facility is determined.

5.4.3.1 Release fractions of the different waste packages

The fraction of the activity inventory released from a package due to the impact of the damage patterns depends on the type of waste. A distinction is made between combustible raw waste, combustible conditioned waste, non-combustible raw waste and conditioned waste. As regards mechanical impacts, it is also taken into account that the released aerosols are released both in respirable form with aerodynamic equivalent diameters <10 µm and as particles >10 µm. For each scenario and each type of waste, release fractions were derived based on the literature referred to in several licensing procedures [45-47], which are listed in Table 2.

The release of radioactivity into the environment in case of thermal and mechanical impacts is then composed as a product of the number of packages affected, the respective nuclide-specific activity inventory and the release fractions listed in Table 2.

Table 2: Release fractions from the different package types, waste types and scenarios

	Thermal impact			**Planar mechanical impact**		**Locally concentrated mechanical impact**	
	Com-bus-tible raw waste	Combus-tible condi-tioned waste	Non-combus-tible waste	Raw waste, 50 % of it respirable	Conditioned waste, 10 % of it respirable	Raw waste, 50 % of it respirable	Conditioned waste, 10 % of it respirable
Cast iron containers	2E-5	2E-5	2E-5	0	0	0	0
Concrete containers	5E-1	4E-3	5E-4	1E-2	4E-4	1,5E-1	6E-3
Konrad IV containers	5E-1	4E-3	5E-4	1E-2	4E-4	1,5E-1	6E-3
20‘ containers	5E-1	4E-3	5E-4	1E-2	4E-4	1,5E-1	6E-3
200 l drums	5E-1	4E-3	5E-4	1E-2	4E-4	1,5E-1	6E-3

For the event “flooding”, a separate conservative model was developed for the release of activity, as this has not previously been considered and therefore no established approach can be found in literature. It was postulated that the waste affected by flooding is dissolved proportionately and the dissolved fraction remains in the aqueous phase after that.

5.4.3.2 Thermal impact

In case of a fire of 5,000 kg kerosene, due to its calorific value, the heat capacity of the package materials and the associated gradual temperature rise as well as due to the package masses, either

- 37 cast iron containers,
- nine Konrad containers Type IV, as well as sheet steel and concrete containers,
- 22 concrete containers (VBA II),
- six 20‘ containers, or
- 250 200 l drums

may be affected such that activity is released from them.

Cast iron containers can be regarded as packages that withstand design basis accidents but also with them, there may be activity releases in case of extreme beyond design basis fires due to the failure of the seals.

As regards the 20' containers and 200 l drums, the potentially combustible waste contained in them may additionally contribute to the fire load. Although this potential additional local fire load may lead to the impairment of other directly adjacent packages, a cliff edge effect cannot occur if the packages are sealed.

In order to also cover the potential additional contribution of combustible waste to the thermal impact with regard to adjacent packages in the considerations, in the following, double the number, i.e. a total of twelve 20' containers and 500 200 l drums, will be considered than affected by the thermal impact.

For the different types of facilities and for each package type contained therein, the potential activity releases were determined on the basis of the representative package inventories listed in Table 1 and the potential release fractions listed in Table 2. According to the number of packages affected in connection with the respective damage pattern type, the high activity inventories listed in Table 1 were generally taken as a basis and only for the affected 200 l drums it was postulated, due to the large number of affected packages, that 25 200 l drums have a high activity inventory and 475 drums have a medium activity inventory according to Table 1. Further, it was postulated as conservative assumption that all packages affected in case of a specific damage pattern type only contain combustible raw waste for which the high release fractions according to Table 2 are taken as a basis. By using conservative parameters, the maximum possible activity releases parameters are determined for events with thermal impact.

Accordingly, the model calculations for the Group I facilities considered show that the release from 22 concrete containers (VBA II) leads to the highest activity releases. For facilities of Group II, it is postulated that there is a release from 500 200 l drums. Here, too, 25 drums have a high and 475 drums have a medium activity inventory according to Table 1. All the waste consists of combustible raw waste.

It is postulated that the activity from the packages damaged by thermal impacts is released into the environment without further retention. The activity releases into the environment determined under these conditions for each group are summarised in Table 3.

Table 3: Nuclide-specific activity releases into the environment following a thermal impact

	Facilities of Group I		**Facilities of Group II**	
Radionuclide	Co-60	Cs-137	Co-60	Ra-226
Activity release [Bq]	7.7E12	3.3E12	4.52E12	5.0E11

5.4.3.3 Mechanical impacts

In the following, it is postulated for facilities of Group I and Group II that mechanical impacts result in a partial building failure. The actual building remains intact, but confinement of the activity is not given. Accordingly, it is postulated as most unfavourable assumption that all of the radioactive material released by the mechanical impacts escapes into the environment without further retention in the building.

Mechanical impacts lead to the formation of aerosol particles which are firstly released into the air inside the facility considered. Here, a distinction is made between particles with sizes from 0 – 10 µm, which are respirable, and particles >10 µm. According to Table 2, as regards raw waste, half of the aerosols generated due to the mechanical impacts are respirable (<10 µm) and the particle size of the other half is >10 µm, while the respirable fraction in conditioned waste is only 10 %. To provide coverage, the most unfavourable assumption is taken as a basis in the following considerations according to which the packages affected by the event are all completely filled with raw waste.

- **Locally concentrated mechanical impact**

In case of a locally concentrated mechanical impact, as it is caused e.g. by the postulated impact of an engine shaft of a high speed military aircraft, either six Type IV sheet steel containers, two Type IV concrete containers, eight concrete containers (VBA II), six 20' containers or 250 200 l drums can be mechanically destroyed. Packages designed against design basis accidents, such as cast iron containers, are not affected by this event.

For each of the group considered and for each package type contained therein, the potential activity releases were determined on the basis of the package inventories listed in Table 1 and the potential release fractions listed in Table 2. For all packages affected, the high activity inventories listed in Table 1 were taken as a basis and only for the affected 200 l drums it was postulated, due to the large number of affected packages, that 25 200 l drums have a high activity inventory and 225 drums have a medium activity inventory according to Table 1.

For Group I facilities it shows that the release from the eight concrete containers (VBA II) with raw waste leads to the highest activity releases. Since for the stress test, in the model calculations for facilities of Group II it is postulated that only 200 l drums are stored in them, here, the release from 250 200 l drums is considered, again postulating that 25 200 l drums have a high activity inventory and 225 drums have a medium activity inventory according to Table 1.

Due to the high impact speed of the engine shaft and the related increased energy input into the affected waste packages, the release fractions for mechanical load cases determined in the literature [45] are significantly increased for the stress test as a model assumption. In this way, very high release fractions are postulated that, however, cover in each case locally concentrated mechanical impacts.

The activity releases into the environment determined in this way providing coverage for both groups are summarised in Table 4.

Table 4: Activity releases into the environment following a locally concentrated mechanical impact in Bq

Aerosol size	**Facilities of Group I**		**Facilities of Group II**	
	Co-60	Cs-137	Co-60	Ra-226
0–10 µm	4.2E11	1.8E11	6.75E11	7.5E10
>10 µm	4.2E11	1.8E11	6.75E11	7.5E10

- **Planar mechanical impact**

In case of a planar mechanical impact, as it is caused e.g. by the postulated roof truss collapse, either 12 Type IV sheet steel containers, 12 Type IV concrete containers, 20 concrete containers (VBA II), eight 20' containers or 84 200 l drums can be mechanically destroyed. Packages designed against design basis accidents, such as cast iron containers, are not affected by this event.

For each of the groups considered and for each package type contained therein, the potential activity releases were determined on the basis of the package inventories listed in Table 1 and the potential release fractions listed in Table 2. For all packages affected, the high activity inventories listed in Table 1 were taken as a basis and only for the affected 200 l drums it was postulated, due to the large number of affected packages, that 25 200 l drums have a high activity inventory and 59 drums have a medium activity inventory according to Table 1. For Group I facilities it showed that the release from the 20 concrete containers (VBA II) with raw waste leads to the highest activity releases. Since for the stress test it is postulated that only 200 l drums are stored in the facilities of Group II, here, the release from 84 200 l drums is considered, again postulating that 25 200 l drums have a high activity inventory and 59 drums have a medium activity inventory according to Table 1.

The activity releases into the environment determined in this way providing coverage for both groups are summarised in Table 5.

Table 5: Activity releases into the environment following a planar mechanical impact in Bq

Aerosol size	**Facilities of Group I**		**Facilities of Group II**	
	Co-60	Cs-137	Co-60	Ra-226
0-10 µm	7.0E10	3.0E10	4.5E10	5.0E9
>10 µm	7.0E10	3.0E10	4.5E10	5.0E9

5.4.3.4 Flooding for ten days

For the stress test, it is postulated that the storage area of the considered facilities of Group I and Group II is 1,000 m² each. Assuming a fully occupied storage area which will then be flooded to a height of 2 m, flooding of 200 Konrad IV containers made of sheet steel, 40 20‘ containers and 500 200 l drums are taken as a basis for the storage facilities with radioactive waste from power plant operation. The flooding of cast iron containers is not further taken into consideration since, as packages designed against design basis accidents, there will be no activity released from them due to flooding. Furthermore, no activity release by leaching from concrete containers and concrete casks will be postulated since the concrete surface will not be affected by the flooding and the packages are completely sealed with concrete. For Group II facilities, 5,000 flooded 200 l drums are postulated.

In the case of storage facilities, additional impairment caused by flooding, such as a loss of power supply, has no influence on a possible release of activity from the packages since the packages stored in the respective facilities are not dependent on active systems. Activity releases can only be caused by water penetration into the packages.

In the following, the medium activity inventory per package is taken as a basis due to the large number of affected packages.

Furthermore, it is postulated that the volume of each package is filled to 75 % with waste so that the remaining voids are filled up with water. To provide coverage, it is postulated that the waste is dissolved by the penetrating water. It is postulated for all types of packages considered that up to 5 % of the waste mass can dissolve. Caesium is postulated to dissolve completely and other solids up to 10 % each so that there are 5 % of the caesium inventory and 0.5 % of the inventory of other solids in the resulting water volume of each package.

Following the flooding, the water completely runs off from the packages. Here it mixes with the other water remained in the storage building. When flowing out of the storage building, the contaminated water is further mixed with the water from the surrounding flooded areas. A dilution factor of 10^{-3} is postulated. Further activity retention by the storage building is not postulated. Furthermore, it is postulated that the contaminated water is distributed in the surrounding area via a plume with a width of 50 m and a length of 2 km in case of a flood height of 2 m. On this basis, the nuclide activity concentration in the flood water of the surrounding area is determined.

Accordingly, for Group I facilities, activity concentrations in the flood water in the surrounding area of 1.2E4 Bq/m³ Co-60 and 5.0E4 Bq/m³ Cs-137 were determined For Group II facilities, activity concentrations of 2.7E4 Bq/m³ Co-60 and 3.0E3 Bq/m³ Ra-226 were obtained.

5.4.3.5 Tidal wave through the storage building

A tidal wave through the storage building with a sudden extreme flood does not lead to a significant activity entry into the environment. Cast iron containers with a package mass of about 8 to 10 Mg, Konrad IV containers, both steel sheet and concrete containers with package masses of about 12 Mg, and 20‘ containers with package masses of about 25 Mg are too heavy to be transported into the surrounding area far from the storage building even in case of an extreme tidal wave. Moreover, also a storage building partially destroyed by a tidal wave still offers enough resistance so that not the entire flow pressure will impact on the waste packages.

However, due to their considerably smaller mass, some 200 l drums may be swept out of the partially destroyed storage building into the surrounding area by the tidal wave. Here, leaching from the drums may occur or they may be partially destroyed. After passing of the tidal wave, the entrained 200 l drums are deposited in the environment. In this case, there is a much smaller number of packages from which radionuclides are leaching outside the facility and may enter a surface water than the number of packages affected in the damage pattern of flooding for ten days. Thus, it is ensured that the activity dispersion resulting from a tidal wave is covered by the previous consideration of a longer-term flooding since there will be a comparable dilution of the activity for each package in the surrounding flood water.

The activity released from the drums deposited in the environment following the flooding may lead to the contamination of soil where a drum is deposited. However, this contamination is only locally limited to its immediate environment. After the tidal wave has passed, the affected area can be located and cordoned off widely and then, decontamination can be carried out. Immediate danger to the public by such local contamination is not to be postulated. The radiological consequences of these events must therefore not be considered. However, regardless of radiological risks, such an event should also be prevented.

5.4.4 Determination of radiation exposure due to potential releases

In the following, the potential exposure is determined for the event sequences postulated in the stress test for facilities of Group I and Group II for different model sites. Based on the different event sequences, model sites are defined for which the respective radiation exposure is determined in relation to the event sequences. These model sites are described below and it will be shown which conditions are also covered by them for specific facilities.

5.4.4.1 Model sites

When defining a model site, the minimum distance of a release of radioactive material to the facility fence is an important variable. Radiation exposure calculations were carried out for different distances and 20 m was postulated as the minimum distance. For a ground-level release, an average effective release height of 8 m above the ground is postulated. In addition, the influence of a building on the radioactive cloud is taken into account which increases the ground-level concentration of radionuclides.

For a buoyant plume rise due to release with thermal load, an average effective release height of 50 m is postulated and the influence of buildings is not taken into account since it would have to be a very tall building if it is to have an impact on dispersion.

Regarding the distance-dependent potential radiation exposure, these assumptions are to be regarded as pessimistic.

- **Model site I – buoyant plume rise due to release with thermal load**

Model site I represents a buoyant plume rise due to release with thermal load. As stated above, an effective release height of 50 m and a minimum distance to the fence of 20 m is postulated. In addition, it is postulated that the entire release of activity takes place within eight hours.

Facilities where the distance to places of residence or work is less than 20 m are not covered by this model site.

- **Model site II – ground-level release due to mechanical load**

Model site II represents a ground-level release in the building. As stated above, an effective release height of 8 m, a minimum building influence length of 10 m, and a minimum distance to the fence of 20 m is postulated. In addition, it is postulated that the entire release of activity takes place within eight hours.

Facilities where the distance to places of residence or work is less than 20 m are not covered by this model site.

This also applies to situations less favourable with regard to the effective release height and the influence of buildings on dispersion. At a site in a densely built-up area, for example, dispersion of radioactive material may be channelled through narrow open spaces between building rows. Here, there may also be buildings that are not directly related to the facility considered, for example in an industrial area or on a research site.

- **Model site III – flooding of a model site**

Model site III represents a storage facility with a storage area of approximately 1,000 m². The waste containers located in this storage facility are flooded, parts of the activity in the waste go into solution and flow off with the water running off (see Chapter 5.4.3.4). Here, runoff with homogeneous activity distribution is postulated. The radiation exposure is determined for the near and the far field according to the general administrative provision (AVV) relating to § 47 of the Radiation Protection Ordinance (StrlSchV) [44].

5.4.4.2 Determination of radiation exposure

For model sites I and II, the radiation exposure is calculated on the basis of the guidance for the expert advisor for radiation protection (*Leitfaden für den Fachberater Strahlenschutz*) [43], using the meteorological parameters of the incident calculation bases relating to § 49 of the Radiation Protection Ordinance (StrlSchV) [48] where for the two mechanical load cases, a particle-size-dependent model was used in addition, which had been developed by GRS within the framework of the KONRAD plan approval procedure. For model site III with dispersion via the water pathway, this is not possible since the guidance is only provided for emissions of radioactive substances in the air. Therefore, the calculations with respect to model site III are carried out according to the general administrative provision (AVV) relating to § 47 of the Radiation Protection Ordinance (StrlSchV) [44].

Dose calculation for airborne emissions:

For the calculation of doses from emissions of radioactive substances in the air, the following exposure pathways are to be taken into account in the early phase of a nuclear accident for a decision on the disaster control measure "evacuation":

- exposure due to intake of radioactive substances with respiratory air (inhalation),
- exposure due to gamma radiation from the plume (gamma submersion), and
- exposure due to gamma radiation from the radioactive substances deposited on the ground within seven days (ground radiation) with continuous stay in the open.

Other exposure pathways can either be neglected because of their minor relevance (beta submersion and direct radiation) or will not be taken into account in such considerations since ingestion can be prevented through early warning against the consumption of freshly harvested food as well as fresh milk from the affected area.

The radiation exposure was determined for the groups of infants (age < 1 year) and adults.

Dose calculation for emissions of radioactive substances in water:

For the calculation of the radiation exposure from emissions of radioactive substances in water, the following exposure pathways are considered on the basis of the general administrative provision (AVV) relating to § 47 of the Radiation Protection Ordinance (StrlSchV) [44]:

For the determination of external radiation exposure:

- exposure through stay on sediment, or
- exposure through stay in flooded areas.

For the determination of internal radiation exposure:

- cattle watering trough – cow – milk,
- cattle watering trough – animal – meet,
- agricultural land use in areas subject to flooding
  - feed plant – cow – milk,
  - feed plant – animal – meet,
  - plant,

- mother milk through intake of radioactive substances by the mother via the above-mentioned ingestion paths.

Here, the influences by flooding for only a short duration and only one time are considered. These approaches provide coverage and are conservative because they take into account some ingestion pathways in addition to the calculation method according to the guidance for the expert advisor for radiation protection [43] and postulate a longer stay on contaminated surfaces.

The radiation exposure is to be calculated for the damage pattern types considered in the stress test and the nuclide-specific activity releases for each model site. Table 6 shows the calculated distant-dependent effective doses for the age group with the highest exposure in each case

Table 6: Effective dose for the damage pattern types considered in mSv

Distance	Facilities of Group I	Facilities of Group II
Thermal impact (model site I)		
20 m	170	100
100 m	49	59
350 m	21	52
500 m	16	42
1,000 m	9	21
2,000 m	5	10
Locally concentrated mechanical impact (model site II)		
20 m	244	870
100 m	68	320
350 m	14	100
500 m	8	66
1,000 m	3	27
2,000 m	1	11
Planar mechanical impact (model site II)		
20 m	40.7	58.0
100 m	11.3	21.3
350 m	2.3	6.7
500 m	1.3	4.4
1,000 m	0.4	1.8
2,000 m	0.1	0.7
Flooding for 10 days (model site III)		
Near field	< 1	< 1
Far field	< 1	< 1

5.4.4.3 Assessment of the radiation exposure determined for the damage pattern types and model sites

The results of the calculations of the radiation exposure for the damage pattern types and model sites are as follows:

- As regards thermal impacts, the level for evacuation remains below the intervention reference level for all facilities considered here from a distance of 100 m.

- As regards locally concentrated mechanical impacts, the level for evacuation remains below the intervention reference level from a distance of 100 m for facilities of Group I. For facilities of Group II, this intervention reference level is complied with from a distance of 350 m.

- As regards planar mechanical impacts, the level for evacuation remains below the intervention reference level for all facilities considered here already from the smallest distance postulated of 20 m.

- As regards flooding, the effective dose is so low that it does not have to be further considered for the stress test.

5.5 Conclusions

In the previous sections, it was examined for the damage pattern types and model sites whether or at what distance the intervention reference level for evacuation could be exceeded. The largest radiological consequences were identified for the damage pattern of a locally concentrated mechanical impact where the intervention reference levels for evacuation are exceeded at a distance of up to about 350 m. The consequences were derived on the basis of generic model assumptions. As long as these model assumptions cover the actual conditions for the facilities to be considered in the individual case, the radiological consequences determined here also provide coverage. If, in the individual case, there are, for example, higher fire loads or higher inventories of dose-relevant radionuclides, larger releases of radioactive material would also be possible. However, a sudden rise of such a release in terms of a cliff-edge effect is not possible for the damage pattern types considered here.

Moreover, the analyses allow recommendations that serve to further reduce potential consequences of design basis and beyond design basis accidents. These recommendations are dealt with in the following Chapter 5.6.

5.6 Summary assessment and recommendations with regard to storage facilities for low- and intermediate-level radioactive waste and conditioning facilities

With this statement, the ESK assesses, on behalf of the BMU, the robustness of the storage facilities for low- and intermediate-level radioactive waste as well as the conditioning facilities for low- and intermediate-level radioactive waste. With this stress test, it is expressly not intended to assess the design requirements reviewed as part of the licensing procedure but design margins that go beyond them. It is therefore investigated how the facilities behave under beyond design basis loads and whether a sudden rise regarding the radiological consequences outside the facility (cliff edge effect) is possible. As assessment criteria for the radiological consequences associated with the beyond design basis loads in the stress test, the intervention reference levels according to the basic recommendations for disaster control [50] are referred to.

The ESK has based the lower cut-off criterion for the facilities actually to be considered in the stress test on the provisions of the Radiation Protection Ordinance (StrlSchV) [4] and includes those facilities in the stress test whose licensed inventory exceeds that for unsealed radioactive material 10^{7} times the exemption levels (total activity pursuant to Appendix III, Table 1, Column 2 StrlSchV) or 10^{10} times the exemption levels for sealed radioactive material.

Which facilities are concerned in particular was determined by a query made by the BMU at the relevant authorities of the *Länder*. In addition, in-depth information was requested on the individual facilities to be considered.

Due to the large number and diversity of facilities to be considered, the different facilities were – contrary to the approach for facilities in the stress test, Part 1 – grouped according to two categories (NPP-related and *Land* collecting facility-/research-related) whose robustness was determined on the basis of the damage pattern types (taking into account the relevant scenarios) with generic radionuclide inventories for different model sites.

In summary, the ESK has come to the following conclusions:

As regards planar mechanical impacts, the level for evacuation remains below the intervention reference level for all facilities considered here already from the smallest distance postulated of 20 m.

As regards thermal impacts, the level for evacuation remains below the intervention reference level for all facilities considered here from a distance of 100 m. As regards locally concentrated mechanical impacts, the intervention reference level is complied with for facilities of Group I (storage facilities and conditioning facilities in which mainly waste from nuclear power plants is handled) from a distance of 100 m, and for facilities of Group II (storage facilities and conditioning facilities in which mainly waste from research institutions and the nuclear industry is handled, as well as *Land* collecting facilities) from a distance of 350 m.

Flooding of the facilities or a tidal wave cannot lead to radiological consequences where the intervention reference levels for evacuation may be exceeded in the surrounding area. However, regardless of this, it should be prevented that packages with radioactive waste will be swept away in the event of a tidal wave.

As long as for the facilities to be considered, the model assumptions cover the actual conditions in the individual case, the radiological consequences determined here also provide coverage. If, in the individual case, there are, for example, higher fire loads or higher inventories of dose-relevant radionuclides, larger releases of radioactive material would also be possible. However, a sudden rise of such a release in terms of a cliff-edge effect is not possible for the damage pattern types considered here.

For minimisation of releases of radioactive material in the event of a thermal impact, the ESK recommends the following:

- The radioactive waste is to be conditioned as soon as possible, as far as technically reasonable, since the release fractions in the event of a fire will be reduced with the degree of conditioning.

- Combustible waste should only be stored to the minimum extent possible since a particularly large fraction of the inventory may be be released from it in the event of a fire.

Furthermore, the ESK points out that fire protection requirements already result from the application of the ESK guidelines for storage facilities for low- and intermediate-level radioactive waste.

Since the impacts were derived on the basis of generic model assumptions regarding the damage patterns, the types and inventories of packages, the condition of the waste, etc., the results apply in a particular case only if these model assumptions cover the actual conditions. In several cases, there is no limitation of inventories in the licence granted so that these may only be limited by other boundary conditions that could not have been further considered here. An in-depth analysis for individual facilities by the ESK was not possible. The following recommendations to conduct further analyses in individual cases are addressed to the competent licensing and supervisory authorities.

The ESK recommends that the respective licensing and supervisory authorities should examine the following aspects for the facilities that fall within their competence. For such investigations, credit can also be taken from the construction, the design of the buildings, the operating requirements and the condition of the waste.

- The ESK based its considerations on data from experience gained with container inventories that provide as much coverage as possible. For some facilities, however, the licensing situation allows larger package-specific inventories or total inventories of radioactive material. The ESK recommends to check for these facilities whether the consequences of postulated mechanical and thermal loads are also limited for the specific licensing situation of the facility such that no major disaster control measures will be required. In this respect, it is also possible to consider the parameters licensed/permissible for the site instead of the covering parameters used here.

- The ESK analyses conducted (see Chapter 5.4.4.2) result in minimum distances from storage buildings to the nearest residential buildings of 100 m (Group I) and 350 m (Group II). Should the actual conditions at a facility show lower minimum distances, the analysis would have to be deepened by facility-specific modelling.

- Check for each facility whether major planar mechanical impacts are possible than postulated in the stress test (here, collapse of a roof truss with a mass of 20 Mg from a height of 10 m).

The aim should always be that major disaster control measures will not be required.

Some facilities are referred to here, by way of example, to show the need for additional analyses the ESK sees for certain cases:

- With the Central Decontamination Department (*Hauptabteilung Dekontaminationsbetriebe - HDB*) at the Karlsruhe Institute of Technology (KIT), there is a storage facility for the treatment and storage of low-and intermediate-level radioactive waste as a service provider. With regard to the actual storage volume and the licensed inventory, this storage facility is of special importance. Here, in particular, the question arises to which extent coverage is provided by the assumptions of the ESK stress test. For the HDB storage facility it is also to be clarified which location is relevant as a reference location for compliance with the intervention levels of disaster control. In this context, the ESK regards it necessary to clarify, for example, whether the workplaces in the various institutes of the Karlsruhe Institute of Technology are covered by a joint emergency protection regime with the HDB or whether they should be included in the dose considerations as places where employees stay separately.

- At the Braunschweig site, the Eckert & Ziegler Nuclitec GmbH operates conditioning facilities[2] for radioactive waste. These facilities were included in the ESK stress test. At the same site, radiopharmaceuticals are produced by the GE Healthcare Buchler GmbH & Co. KG in a facility which – since it has no waste management function – does not fall within the scope of the ESK stress test. The possibility of interaction between releases of radioactive substances from these facilities had therefore not to be examined by the ESK, but should be considered by the competent authority.

- Situations similar to that at the site in Braunschweig may also occur elsewhere if more than one facility is located at the same site. Here, the question arises to which extent a stress case could lead to a simultaneous impact on several facilities located on a site which, in total, leads to a significantly higher impact than determined in the calculations for the damage pattern types.

6 Disposal facilities for radioactive waste

As far as radioactive waste is handled in the part of the disposal facility above ground, the same damage pattern types may be referred to for the stress test as defined for the storage facilities for low-and intermediate-level radioactive waste.

Releases of radioactive substances from the underground part of the disposal facility, which could enter an aquifer only in the long term, are the subject of investigations within the respective plan approval procedures. Damage patterns where load impacts on waste under ground could lead to releases with exhaust air that are larger than in the analyses on the damage pattern types for the above-ground part are not possible. As regards disposal facilities, the ESK stress test is therefore limited to above-ground facilities.

[2] Here, it was stated in the original version dated 11.07.2013 that a storage facility is also operated there. This statement is not correct and has therefore been deleted. The recommendation of the ESK in this section remains otherwise unaffected.

For the above-ground facilities, the ESK prepared a list of questions [6] which was sent to the Repository Surveillance of the Federal Office for Radiation Protection (BfS) as well as to the competent nuclear licensing and supervisory authorities of the *Länder* by the BMU on 31.01.2013. It serves to gather more detailed information on the activities carried out, the licensed inventories and the buildings and rooms in which the waste is handled.

As radiological criteria for the stress test, the same criteria are referred to as for the storage and conditioning facilities for low- and intermediate-level radioactive waste (see Chapter 5.2).

6.1 Questions in the ESK stress test

The following shows the list of questions of the ESK of 28.01.2013 [6], which was sent to the competent nuclear licensing and supervisory authorities of the *Länder* and the Repository Surveillance of the BfS by the BMU. The list is divided into "general" and "more detailed" questions:

“**General questions**

1. Which above-ground storage and handling activities are authorised within the scope of the existing licence and the existing planning approval?

2. In what form (e.g. unsealed, conditioned, unsealed or sealed packages) may radioactive material exist? How much and what isotopes may exist?

3. To what extent the currently licensed above-ground storage and handling activities are actually being made use of?

More detailed questions

Note: These questions are to be answered only for those facilities for which above-ground storage and handling activities are currently licensed.

Please provide us with data for all above-ground facilities for the disposal of radioactive waste on the required information as stated under 1. to 5. below, also considering all licensed storage and handling activities.

1. Those excerpts from the licence/the planning approval relating to the above-ground storage and handling activities, including all officially confirmed amendments, restrictions or extensions that are currently valid and relevant for this topic.”

2. to 5. correspond to 2. to 5. of Part 2 of the list of questions relating to storage and conditioning facilities (see Chapter 5.1, page 6).

6.2 Disposal facilities considered in the stress test

In Germany, there are three facilities for the disposal of radioactive waste that had to be considered in the ESK stress test. These are the Asse II mine repository, the Morsleben repository for radioactive waste (ERAM) and the Konrad mine repository. These disposal facilities will first of all be described particularly with regard to their above-ground handling of radioactive waste.

6.2.1 Asse II mine repository

The Asse II mine is a former salt mine where low-and intermediate-level radioactive waste was emplaced between 1967 and 1978. With the amendment of the Atomic Energy Act of 17.03.2009 it was stipulated that the Asse II mine is to be treated like a disposal facility and must be shut down immediately. The operator, i.e. the BfS, currently prefers removal of the waste, its storage and finally its emplacement in another disposal facility.

Without retrieval of waste, no waste is handled in the above-ground part of the Asse II mine which would have to be considered here regarding their radioactivity inventory. The waste produced during current operation to keep the mine open, in particular intruding saline solutions, is far below the cut-off criteria for the ESK stress test, i.e. 10^7 times the exemption levels for unsealed radioactive material or 10^{10} times the exemption levels for sealed radioactive material.

Prior to retrieval of waste, fact finding has to take place to enable planning of the retrieval. If retrieval will actually take place, the stress test should be conducted within the framework of the review procedure that will then be performed. Only then it would be clarified which confinement measures and waste treatment facilities are to be realised and where storage will take place.

For these reasons, the Asse II mine repository is not to be further considered here.

6.2.2 Morsleben repository for radioactive waste (ERAM)

In the former GDR, the twin mine Marie/Bartensleben near the village of Morsleben no longer used for rock salt and potash mining was converted into a repository for the disposal of low- and intermediate-level waste. In 1981, the ERAM started operations and was granted a permanent operating licence on 22.04.1986. On 03.10.1990, the responsibility for the ERAM was transferred to the Federal Office for Radiation Protection (BfS) as the operator.

Until early 1991, radioactive waste from the former GDR, or the new *Länder* respectively, was disposed of there. From 13.01.1994 to 28.09.1998, further emplacement of radioactive waste took place including waste from the old (i.e. West German) *Länder*. With the amendment to the Atomic Energy Act (AtG) dated 22.04.2002, § 57a was amended such that operation of the ERAM to keep the mine open is possible, but acceptance of radioactive waste for disposal is excluded.

Currently, the Ministry of Agriculture and the Environment of Saxony-Anhalt (MLU) conducts a plan approval procedure for the decommissioning of the ERAM. As part of the decommissioning, it is planned to backfill most of the mine openings mainly with salt concrete and to seal the Bartensleben/Marie mines and the emplacement areas.

In the above-ground parts of the facility, there is only handling of radioactive waste. The waste produced during current operation to keep the mine open is far below the cut-off criteria for the ESK stress test, i.e. 10^7 times the exemption levels for unsealed radioactive material or 10^{10} times the exemption levels for sealed radioactive material.

Before 1990, the ERAM was also used for the storage of radioactive waste, i.e. a container with radium waste and several cobalt-60 radiation sources. The BfS applied for the disposal also of this waste stored in the ERAM as a provisional measure. Would the drum with radium waste be removed and handled above ground, so this would be handling of radioactive waste with an activity of 3.7E11 Bq Ra-226. In the above stress test for storage facilities, impacts on 200 l drums with high and medium activity inventories of Ra-226 were examined for the damage pattern types. The Ra-226 inventories affected in each case amounted to 1E12 Bq. Taking into account the releasability of Ra-226 from the drum stored in the ERAM (mostly vitrified products) compared with the model assumptions for the storage facilities (combustible raw waste) the case of a future above-ground handling of the Ra-226 drum would also be covered by the assessments in Chapter 5.4. Excess of the intervention reference level for evacuation in the surrounding area of the ERAM is not possible for the damage pattern types considered.

6.2.3 Konrad mine repository

The Konrad mine repository is a former iron ore mine where iron ore was mined from 1965 until 1976. From 1975 to 1982, the mine was examined with respect to its suitability as a repository for non-heat-generating waste. In 1982, the competent authority at that time, the Federal Institute of Physics and Metrology (*Physikalisch-Technische Bundesanstalt - PTB*) filed an application for initiation of the plan approval procedure. In 2002, the Lower Saxony Ministry of Environment issued the plan approval decision. According to current plans, acceptance and emplacement of radioactive waste will not to be started before 2021.

The radioactive waste is delivered to and disposed of in the Konrad repository in concrete and cast iron casks as well as in steel, concrete and cast iron containers. Upon delivery, all waste must have been conditioned to comply with the Konrad waste acceptance criteria. In the transfer hall, the dose rate and surface contamination of all waste packages are measured as incoming inspection. Other controls, such as for quality assurance of conditioning, are conducted before the packages are transported to the repository.

Solid and liquid radioactive operational waste is only produced to a small extent. These are not to be further considered here due to the cut-off criteria for the ESK stress test, i.e. 10^7 times the exemption levels for unsealed radioactive material or 10^{10} times the exemption levels for sealed radioactive material.

The above-ground storage capacities only serve the purpose of buffer storage and are limited accordingly. In case of disturbances in the operation of the mine, up to 258 transport units could be stored in the buffer storage facility. A major safety advantage in the stress test is the fact that all radioactive waste is conditioned in such a form to comply with the waste disposal requirements. For the stress test of the storage facilities, waste characteristics were postulated that provide coverage with regard to the releasability of radioactive material, i.e. combustible raw waste. A comparison of the release fractions for different package types, waste types and damage patterns in Table 2 shows that in case of a mechanical impact the releases from conditioned waste is lower by a factor of 25 and in case of a thermal impact lower by a factor of 1,000 than those from waste types postulated for the stress test of the storage facilities. Thus, excess of the intervention reference level for evacuation in the surrounding area of the Konrad mine repository is not possible for the damage pattern types considered.

6.3 Summary assessment and recommendations with regard to the disposal facilities

In the ESK stress test, the above-ground part of disposal facilities is considered. For this part of the disposal facilities, the same damage pattern types can be referred to as for the storage facilities for low- and intermediate-level radioactive waste. There are also the same radiological criteria applied, namely the compliance with the intervention reference level for evacuation.

In Germany, there are three facilities for the disposal of radioactive waste considered in the ESK stress test. These are the Asse II mine repository, the Morsleben repository for radioactive waste (ERAM) and the Konrad mine repository. Information on the activities carried out, the licensed inventories and the buildings and rooms in which the waste is handled was requested from the Repository Surveillance of the BfS and from the competent authorities of the *Länder* by the BMU.

For all three disposal facilities considered, the stress test results in the robustness of the above-ground part against the postulated loads defined in the form of the damage pattern types. Excess of the intervention reference level for evacuation in the surrounding area is not possible under these loads.

7 References

[1] BMU-Beratungsauftrag (Az.: RS III 3 – 17 005/0) vom 22.06.2011,
betr. Sicherheitsüberprüfung von Einrichtungen zur Entsorgung radioaktiver Abfälle und bestrahlter Brennelemente, Wärme entwickelnder und anderer Arten radioaktiver Abfälle

[2] BMU-Beratungsauftrag (Az.: RS III 3 – 17 005/0) vom 18.07.2011,
betr. Sicherheitsüberprüfung von Einrichtungen zur Entsorgung radioaktiver Abfälle und bestrahlter Brennelemente, Wärme entwickelnder und anderer Arten radioaktiver Abfälle

[3] ESK-Stresstest für Anlagen und Einrichtungen der Ver- und Entsorgung in Deutschland
Teil 1: Anlagen der Brennstoffversorgung, Zwischenlager für bestrahlte Brennelemente und Wärme entwickelnde radioaktiver Abfälle, Anlagen zur Behandlung bestrahlter Brennelemente
Stellungnahme der Entsorgungskommission vom 14.03.2013

[4] Strahlenschutzverordnung vom 20. Juli 2001 (BGBl. I S. 1714, (2002, I S. 1459)) zuletzt geändert durch Artikel 5 Absatz 7 des Gesetzes
vom 24. Februar 2012 (BGBl. I S. 212)

[5] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17 031-4/1) vom 20.09.2011 an den Länderausschuss für Atomkernenergie – Fachausschuss Ver- und Entsorgung

[6] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 12.06.2012 an die Senatsverwaltung für Stadtentwicklung und Umwelt - Berlin, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

mit einer Anlage

1 Übergeordnete Fragenliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 06.06.2012

[7] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 12.06.2012 an das Ministerium für Umwelt, Klima und Energiewirtschaft Baden-Württemberg, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

mit einer Anlage

1 Übergeordnete Fragenliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 06.06.2012

[8] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 12.06.2012 an das Ministerium für Wirtschaft, Klimaschutz, Energie und Landesplanung Rheinland-Pfalz, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

mit einer Anlage

1 Übergeordnete Fragenliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 06.06.2012

[9] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 29.06.2012 an das Ministerium für Umwelt, Gesundheit und Verbraucherschutz in Potsdam, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

mit einer Anlage

1 Übergeordnete Fragenliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 06.06.2012

[10] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 12.06.2012 an das hessische Ministerium für Umwelt, Energie, Landwirtschaft und Verbraucherschutz, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

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1 Übergeordnete Fragenliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 06.06.2012

[11] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 12.06.2012 an das Ministerium für Inneres und Sport Mecklenburg-Vorpommern, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

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1 Übergeordnete Fragenliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 06.06.2012

[12] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 12.06.2012 an das Niedersächsische Ministerium für Umwelt und Klimaschutz, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

mit einer Anlage

1 Übergeordnete Fragenliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 06.06.2012

[13] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 12.06.2012 an das Ministerium für Wirtschaft, Energie, Bauen, Wohnen und Verkehr des Landes Nordrhein-Westfalen, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

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[14] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 12.06.2012 an das Ministerium für Wirtschaft, Klimaschutz, Energie und Landesplanung Rheinland-Pfalz, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

mit einer Anlage

1 Übergeordnete Fragenliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 06.06.2012

[15] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 29.06.2012 an das Sächsische Staatsministerium für Umwelt und Landwirtschaft, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

mit einer Anlage

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[16] Schreiben des Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (Az.: RS III 3 – 17031/4.1) vom 12.06.2012 an das Ministerium für Justiz, Naturschutz und Integration des Landes Schleswig-Holstein, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 6. Juni 2012

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[17] E-Mail der Senatsverwaltung für Stadtentwicklung und Umwelt des Landes Berlin an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit vom 15.08.2012;

mit drei Anlagen

1 Anlage 1: Antworten zu den gestellten Fragen
2 Anlage 1: Matrix zur Beantwortung der Frage 1; Landessammelstelle Berlin
3 Landesamt für Arbeitsschutz, Gesundheitsschutz und technische Sicherheit Berlin – LAGetSi – Genehmigungsbescheid U 2033/2003 vom 30.12.2003

[18] Schreiben des Ministeriums für Wirtschaft, Klimaschutz, Energie und Landesplanung des Landes Rheinland-Pfalz (Az.: 86-84 357/2012-2#7) vom 03.08.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, übergeordnete Fragenliste der Entsorgungskommission für den Stresstest für Anlagenkategorien 4 und 5 vom 06. Juni 2012

mit zwei Anlagen

1 Anlage 1 zum Schreiben vom 03.08.2012: Beantwortung der Fragenliste für die Anlage KMK, Auszug aus der Genehmigung für die Stilllegung und die Abbauphase 1a vom 16.07.2004

2 Anlage 2 zum Schreiben vom 03.08.2012: Beantwortung der Fragenliste für den TRIGA Mark II Reaktor der Johannes Gutenberg Universität Mainz; Kopie der Genehmigung vom 28.07.1965

[19] Schreiben des Ministeriums für Umwelt, Klima und Energiewirtschaft des Landes Baden Württemberg (Az.: 3-4643.00) vom 20.09.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: ESK-Stresstest für Anlagen und Einrichtungen der Ver- und Entsorgung

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3 EnBW Kernkraft GmbH, Kernkraftwerk Obrigheim, Berichts-Nr.: 2012/25, Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung – Übergeordnete Fragenliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 06.06.2012

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5 Umweltministerium Baden-Württemberg, Zusammenfassende Lesefassung der Genehmigung K 95/83 nach § 9 Atomgesetz für die Hauptabteilung Dekontaminationsbetriebe (HDB) der Wiederaufarbeitungsanlage Karlsruhe Rückbau- und Entsorgungs-GmbH (WAK GmbH), Stand: 01.01.2010

6 Zusätzliche Daten zu den Lagern für radioaktive Abfälle in den Kernkraftwerken; Beantwortung durch EnKK (Stand: 12.09.2012)

[20] Schreiben des Ministeriums für Umwelt, Klima und Energiewirtschaft des Landes Baden-Württemberg (Az.: 3-4643.00) vom 21.06.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: ESK-Stresstest für Anlagen und Einrichtungen der Ver- und Entsorgung

[21] Schreiben des Ministeriums für Umwelt, Gesundheit und Verbraucherschutz des Landes Brandenburg (Az.: 34-0113/35+1.3) vom 31.07.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung Frageliste der Entsorgungskommission

mit einer Anlage

1 Schreiben der Energiewerke Nord GmbH (EWN) (Az.: krp-shl-kl) vom 30.07.2012 an das Ministerium für Umwelt, Gesundheit und Verbraucherschutz des Landes Brandenburg, mit 14 Anlagen

[22] Schreiben des Niedersächsischen Ministeriums für Umwelt, Energie und Klimaschutz (Az.: 41 – 01374) vom 10.09.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Übergeordnete Fragenliste der ESK vom 06.06.2012 – Kategorie 4 und 5

mit einer Anlage

1 EZN Braunschweig-Thune
Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung; Fragenliste der Entsorgungskommission vom 6. Juni 2012; Anlage zur Konditionierung von schwach- und mittelaktiven Abfällen am Standort Braunschweig

[23] Schreiben des Niedersächsischen Ministeriums für Umwelt, Energie und Klimaschutz (Az.: 41 – 01374) vom 27.08.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung

mit einer Anlage

1 Anlage 1: Matrix zur Beantwortung der Frage 1

[24] Schreiben des Niedersächsischen Ministeriums für Umwelt, Energie und Klimaschutz (Az.: 42 – 40311/12-21.5) vom 27.06.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Sicherheitsüberprüfung (Stresstest) von Anlagen und Einrichtungen der Entsorgung, Vorabfrage zu Anlagen und Einrichtungen der Entsorgung in Niedersachsen; Kernkraftwerk Stade;

[25] Schreiben des Niedersächsischen Ministeriums für Umwelt, Energie und Klimaschutz (Az.: 41 – 01374) vom 16.08.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung

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2 GNS
Abfalllager Gorleben (ALG); Beantwortung der Fragenliste der Entsorgungskommission vom 06. Juni 2012
09.08.2012, Nr. EBG1 2012/001, Rev.: 0

3 Schreiben der E.ON Kernkraft GmbH (Az.: TSE-Sd/Bug) vom 27.07.2012 an das Niedersächsische Ministerium für Umwelt, Energie und Klimaschutz; betr.: Kernkraftwerk Unterweser, Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der Entsorgungskommission vom 06. Juni 2012

4 EZN Braunschweig-Thune
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5 Schreiben des Niedersächsischen Ministeriums für Umwelt, Energie und Klimaschutz (Az.: 42-40311/12-21.5) vom 26.06.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Sicherheitsüberprüfung (Stresstest) von Anlagen und Einrichtungen der Entsorgung, Vorabfrage zu Anlagen und Einrichtungen der Entsorgung in Niedersachsen; Forschungs- und Messreaktor Braunschweig (FMRB)

6 Schreiben der E.ON Kernkraft GmbH (Az.: KKS-TÜE/Bc-tie) vom 26. Juli 2012 an das Niedersächsische Ministerium für Umwelt, Energie und Klimaschutz; betr.: Kernkraftwerk Stade, Schreiben des NMU vom 17.07.2012, Lager für radioaktive Abfälle, Sicherheitsüberprüfung (Stresstest) durch die

Entsorgungskommission, Vorabfrage

7 Schreiben der Kernkraftwerk Lingen GmbH (Az.: 0862.1 0000) vom 03.08.2012 an das Niedersächsische Ministerium für Umwelt, Energie und Klimaschutz; betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Übergeordnete Frageliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 6.6.2012

[26] Schreiben des Ministeriums für Energiewende, Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein (Az.: V 711) vom 16.10.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: ESK-Stresstest für Anlagen und Einrichtungen der Ver- und Entsorgung

mit vier Anlagen

1 E.ON Kernkraft GmbH
Standort-Zwischenlager Brokdorf
Sicherheitsüberprüfung von Anlagen und Einrichtungen zur Entsorgung bestrahlter Brennelemente, Wärme entwickelnder radioaktiver Abfälle und anderer Arten radioaktiver Abfälle sowie Anlagen der Versorgung
Stellungnahme zur Frageliste der Entsorgungskommission (ESK)
vom 29. Mai 2012
Stand: 07.08.2012

2 Standort-Zwischenlager Brunsbüttel
Bericht 2012-0011, Technischer Bericht
Sicherheitsüberprüfung von Anlagen und Einrichtungen zur Entsorgung bestrahlter Brennelemente, Wärme entwickelnder radioaktiver Abfälle und anderer Arten radioaktiver Abfälle sowie Anlagen der Versorgung
Stellungnahme zur Frageliste der Entsorgungskommission (ESK)
vom 29. Mai 2012
Stand: 30.07.2012

3 Standort-Zwischenlager Krümmel
Arbeits-Bericht
Sicherheitsüberprüfung von Anlagen und Einrichtungen zur Entsorgung bestrahlter Brennelemente, Wärme entwickelnder radioaktiver Abfälle und anderer Arten radioaktiver Abfälle sowie Anlagen der Versorgung
Stellungnahme zur Frageliste der Entsorgungskommission (ESK)
vom 29. Mai 2012
Stand: 17.07.2012

4 HAKONA (Geb. 44) und Otto-Hahn-RDB-Schacht

[27] Schreiben des Staatsministeriums für Umwelt und Landwirtschaft des Landes Sachsen (Az.: 54-4644.20/1/2) vom 16.08.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung

mit zwei Anlagen

1 VKTA
Übergeordnete Frageliste der ESK für den Stresstest für die Anlagenkategorie 4, Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung des VKTA, Zusammenfassung der Antworten gemäß Schreiben des SMUL vom 09.07.2012 für das Zwischenlager Rossendorf (ZLR) mit 13 Anlagen

2 VKTA
Übergeordnete Frageliste der ESK für den Stresstest für die Anlagenkategorie 5, Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung des VKTA, Zusammenfassung der Antworten gemäß Schreiben des SMUL vom 09.07.2012 für die Einrichtung zur Behandlung schwachradioaktiver Abfälle Rossendorf (ESR) mit neun Anlagen

[28] Schreiben des Ministeriums für Inneres und Sport Mecklenburg-Vorpommern (Az.: II 416 - 07100) vom 20.08.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Sicherheitsüberprüfung an Anlagen und Einrichtungen zur Ver- und Entsorgung

mit elf Anlagen

1 Innenministerium Mecklenburg-Vorpommern
Genehmigung nach § 3 StrlSchV zur Konditionierung und Zwischenlagerung von radioaktiven Reststoffen/Abfällen im Zwischenlager Nord (ZLN), Rubenow
20.02.1998

2 Umweltministerium Mecklenburg-Vorpommern
1. Änderung der Genehmigung nach § 3 StrlSchV zur Konditionierung und Zwischenlagerung von radioaktiven Reststoffen/Abfällen im Zwischenlager Nord (ZLN), Rubenow vom 20. Februar 1998
31. Mai 2000

3 Umweltministerium Mecklenburg-Vorpommern
2. Änderung der Genehmigung nach § 3 StrlSchV zur Konditionierung und Zwischenlagerung von radioaktiven Reststoffen/Abfällen im Zwischenlager Nord (ZLN), Rubenow vom 20. Februar 1998
23. Oktober 2000

4 Umweltministerium Mecklenburg-Vorpommern
3. Änderung der Genehmigung nach § 3 StrlSchV (a. F) zur Konditionierung und Zwischenlagerung von radioaktiven Reststoffen/Abfällen im Zwischenlager Nord (ZLN), Rubenow vom 20. Februar 1998
28. März 2003

5 Umweltministerium Mecklenburg-Vorpommern
4. Änderung der Genehmigung nach § 3 StrlSchV (a. F) zur Konditionierung und Zwischenlagerung von radioaktiven Reststoffen/Abfällen im Zwischenlager Nord (ZLN), Rubenow vom 20. Februar 1998
26. September 2003

6 Innenministerium Mecklenburg-Vorpommern
5. Änderung der Genehmigung nach § 3 StrlSchV (a. F) zur Konditionierung und Zwischenlagerung von radioaktiven Reststoffen/Abfällen im Zwischenlager Nord (ZLN), Rubenow vom 20. Februar 1998
16. August 2007

7 Innenministerium Mecklenburg-Vorpommern
6. Änderung der Genehmigung nach § 3 StrlSchV (a. F) zur Konditionierung und Zwischenlagerung von radioaktiven Reststoffen/Abfällen im Zwischenlager Nord (ZLN), Rubenow vom 20. Februar 1998
11. Dezember 2007

8 Schreiben des Innenministeriums Mecklenburg-Vorpommern (Az.: 4165.3.34) vom 26.06.1997 an die Energiewerke Nord GmbH; Genehmigungsbescheid zum Umgang mit sonstigen radioaktiven Stoffen in der Zentralen Aktiven Werkstatt (ZAW) des Kernkraftwerkes Lubmin/Greifswald

9 Schreiben des Umweltministeriums Mecklenburg-Vorpommern (Az.: X620-4165.3.421) vom 22.06.2000 an die Energiewerke Nord GmbH; 2. Änderungsgenehmigung zur „Genehmigung zum Umgang mit sonstigen radioaktiven Stoffen in der Zentralen Aktiven Werkstatt (ZAW) des Kernkraftwerkes Lubmin/Greifswald" vom 26. Juni 1997

10 Schreiben des Umweltministeriums Mecklenburg-Vorpommern (Az.: X540a-4165.3.43) vom 18.11.2004 an die Energiewerke Nord GmbH; 3. Änderungsgenehmigung zur „Genehmigung zum Umgang mit sonstigen radioaktiven Stoffen in der Zentralen Aktiven Werkstatt (ZAW) des Kernkraftwerkes Lubmin/Greifswald" vom 26. Juni 1997

11 Schreiben des Umweltministeriums Mecklenburg-Vorpommern vom 16.08.1999 an die Energiewerke Nord GmbH und die Zwischenlager Nord GmbH; Genehmigung für den Umgang mit sonstigen radioaktiven Stoffen und kernbrennstoffhaltigen Abfällen in der Landessammelstelle des Landes Mecklenburg-Vorpommern (LSS M-V)

[29] Schreiben des Hessischen Ministeriums für Umwelt, Energie, Landwirtschaft und Verbraucherschutz (Az.: IV6-99.0.4.4.4) vom 27.08.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Fachausschuss für Ver- und Entsorgung, Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung infolge der Ereignisse in Japan durch die ESK

mit fünf Anlagen

1 Betroffene Einrichtung: LAW Lager Biblis
2 Betroffene Einrichtung: BZL Halle 2, Biblis
3 NCS Halle 12, Hanau
4 Betroffene Einrichtung: LAW Lager und BZL Biblis
5 RWE Schreiben an das Hessische Ministerium für Umwelt, Energie, Landwirtschaft und Verbraucherschutz vom 01.08.2012

[30] Schreiben des Ministeriums für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen (Az.: III 3 – 8331.1) vom 21.09.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung

mit drei Anlagen

1 Schreiben der Bezirksregierung Düsseldorf (Az.: 55.3-Str 2160/09-Ra) vom 24.05.2012 an die GNS – Gesellschaft für Nuklear-Service mbH; betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), 3. Änderungsbescheid für die Genehmigung U 33/02 zum Umgang mit radioaktiven Stoffen vom 13.11.2001 in der Fassung des Änderungsbescheids vom 03.07.2007

2 GNS-Betriebsstätte Duisburg
Beantwortung der Fragenliste der Entsorgungskommission vom 06.06.2012
28.08.2012

3 Schreiben der Bezirksregierung Düsseldorf (Az.: 55.3-8331.1-Ra) vom 18.09.2012 an das Ministerium für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen; betr.: Durchführung der Strahlenschutz-verordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung – GNS Betriebsstätte Duisburg

[31] Schreiben des Ministeriums für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen (Az.: III 3 – 8331.1) vom 21.09.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung

mit 18 Anlagen

1 III 3 -8331.1
Genehmigungen nach § 3 Abs. 1 StrlSchV (alt): Lagerung kernbrennstoffhaltiger Abfälle im Forschungszentrum Jülich – Kurzdarstellung der Inhalte
Düsseldorf, 19.09.2012

2 Forschungszentrum Jülich
N-DZ, Nuklearservice-Lagerhalle II
Geb. 12.6, Gen. 3/3
Antworten zur übergeordneten Frageliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5, Teil 2, Punkt 1 – 5

3 Forschungszentrum Jülich
N-DZ, Nuklearservice-Abfallzellen
Geb. 12.6, Gen. 3/4
Antworten zur übergeordneten Frageliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5, Teil 2, Punkt 1 – 5

4 Forschungszentrum Jülich
N-DZ, Nuklearservice Geb. 12.6
Abfalllager 1 und Betriebshof Gen. 3/5
Antworten zur übergeordneten Frageliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5, Teil 2, Punkt 1 – 5

5 Schreiben der Bezirksregierung Köln vom 11.09.2012 an das Ministerium für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen, Referat III 3
Durchführung der Strahlenschutzverordnung (StrlSchV)
Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung – FZJ GmbH
Erlass vom 30.07.2012; Az.: III 3 – 8331.1 / 1211 ESK

6 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (- III C 5 – 8950.1 -) und des Ministers für Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen (- III/C 5 – 54 – 12 -) vom 10.11.1981 an die Kernforschungsanlage Jülich GmbH (KFA), betr.: Genehmigung Nr. 3/3 (Betr.: Betriebsabteilung Dekontamination - Lagerhalle II -)

7 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (Az.: III A 6 – 8950.11) vom 22.10.1987 an die Kernforschungsanlage Jülich GmbH, betr.: Genehmigung zur Beseitigung kernbrennstoffhaltiger Abfälle nach § 3 Abs. 1 der Strahlenschutzverordnung (StrlSchV), hier: Betriebsabteilung Dekontamination - AVR-Behälterlager –
1. Nachtrag zur Genehmigung 3/3

8 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (Az.: III A 6 – 8950.11) vom 08.12.1987 an die Kernforschungsanlage Jülich GmbH, betr.: Genehmigung zur Beseitigung kernbrennstoffhaltiger Abfälle nach § 3 Abs. 1 der Strahlenschutzverordnung (StrlSchV), hier: Betriebs Dekontamination – Lagerhalle II / AVR-Behälterlager –
2. Nachtrag zur Genehmigung 3/3

9 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (- III C 5 – 8950.11 -) und des Ministers für Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen (- III/C 5 – 54 – 12 -) vom 23.11.1981 an die Kernforschungsanlage Jülich GmbH (KFA), betr.: Genehmigung Nr. 3/4 (Betr.: Betriebsabteilung Dekontamination - AVR-Brennelement-Zwischenlager im 2. Bauabschnitt der Abfallzellenanlage -)

10 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (- III C 5 – 8950.11 -) und des Ministers für Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen (- III/C 5 – 54 – 12 -) vom 11.10.1982 an die Kernforschungsanlage Jülich GmbH (KFA), betr.: 1. Nachtrag zur Genehmigung Nr. 3/4 (Betr.: Betriebsabteilung Dekontamination, 2. Bauabschnitt der Abfallzellenanlage)

11 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (- III C 5 – 8950.11 -) und des Ministers für Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen (- III/C 5 – 54 – 12 -) vom 17.10.1983 an die Kernforschungsanlage Jülich GmbH (KFA), betr.: 2. Nachtrag zur Genehmigung Nr. 3/4 (Betr.: Betriebsabteilung Dekontamination, 2. Bauabschnitt der Abfallzellenanlage)

12 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (Az.: III A 6 – 8950.11) vom 07.08.1986 an die Kernforschungsanlage Jülich GmbH, betr.: Genehmigung zur Beseitigung kernbrennstoffhaltiger Abfälle nach § 3 Abs. 1 der Strahlenschutzverordnung (StrlSchV), hier: Kalorimetrische Messungen an Abfallfässern in der Be- und Entladezelle der Abfallzellenanlage
3. Nachtrag zur Genehmigung 3/4

13 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (Az.: III A 6 – 8950.11) vom 12.06.1987 an die Kernforschungsanlage Jülich GmbH, betr.: Genehmigung zur Beseitigung kernbrennstoffhaltiger Abfälle nach § 3 Abs. 1 der Strahlenschutz-verordnung (StrlSchV), hier: Betriebsabteilung Dekontamination (TD-DE) im Gebäude Nr. 12.6 auf dem Forschungsgelände in Jülich, 4. Nachtrag zur Genehmigung 3/4 (AVR-Trockenlager)

14 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (- III C 5 – 8950.11 -) und des Ministers für Wirtschaft, Mittelstand und Verkehr des Landes Nordrhein-Westfalen (- III/C 5 – 54 – 12 -) vom 04.07.1984 an die Kernforschungsanlage Jülich GmbH (KFA), betr.: Genehmigung 3/5 (Betr.: Betriebsabteilung Dekontamination; Abfalllager und 1. Bauabschnitt der Abfallzellenanlage)

15 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (Az.: III A 6 (II D 6)– 8950.11) vom 23.12.1985 an die Kernforschungsanlage Jülich GmbH, betr.: 1. Nachtrag zur Genehmigung 3/5 (Betriebsabteilung Dekontamination; Betriebshof des Abfalllagers)

16 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (Az.: III A 6 (II D 6)– 8950.11) vom 12.06.1986 an die Kernforschungsanlage Jülich GmbH, betr.: Genehmigung zur Beseitigung radioaktiver Abfälle als gewöhnliche Abfälle nach § 3 Abs. 1 der Strahlenschutzverordnung (StrlSchV), hier: Betriebsabteilung Dekontamination – TD-DE –
2. Nachtrag zur Genehmigung 3/5

17 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (Az.: III A 6 – 8950.11) vom 09.07.1986 an die Kernforschungsanlage Jülich GmbH, betr.: Genehmigung zur Beseitigung radioaktiver Abfälle als gewöhnliche Abfälle nach § 3 Abs. 1 der Strahlenschutzverordnung (StrlSchV), hier: Betriebsabteilung Dekontamination – TD-DE –
3. Nachtrag zur Genehmigung 3/5

18 Schreiben des Ministers für Arbeit, Gesundheit und Soziales des Landes Nordrhein-Westfalen (Az.: III A 6 – 8950.11) vom 17.09.1986 an die Kernforschungsanlage Jülich GmbH, betr.: Genehmigung zur Beseitigung radioaktiver Abfälle als gewöhnliche Abfälle nach § 3 Abs. 1 der Strahlenschutzverordnung (StrlSchV), hier: Betriebsabteilung Dekontamination – TD-DE –
4. Nachtrag zur Genehmigung 3/5

[32] Schreiben des Ministeriums für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen (Az.: III 3 – 8331.1) vom 14.09.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung

mit neun Anlagen

1 Schreiben der Bezirksregierung Köln (Az.: 55.8331-Ra) vom 11.09.2012 an das Ministerium für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung – GNS Jülich
Antworten zur Fragenliste

2 Bezirksregierung Köln (Az.: 55.8331-U6/2011-Ra) vom 28.10.2011 an die GNS – Gesellschaft für Nuklear-Service mbH
Genehmigung U 6/2011 zum Umgang mit radioaktiven Stoffen, Betrieb einer Trocknungsanlage

3 Bezirksregierung Köln (Az.: 55.8331-U6/2011-1-Ra) vom 22.05.2012 an die GNS – Gesellschaft für Nuklear-Service mbH
1. Nachtrag zur Genehmigung U 6/2011 zum Umgang mit radioaktiven Stoffen, Änderungen beim Betrieb einer Trocknungsanlage

4 GNS
Technische Notiz
GNS-Trocknungsanlage Jülich (TAJ), betr.: Beantwortung der Fragenliste der Entsorgungskommission vom 06.06.2012
24.08.2012

5 Bezirksregierung Köln (Az.: 55.3-Str 2133/08-Ra) vom 25.02.2009 an die GNS – Gesellschaft für Nuklear-Service mbH
Änderungsbescheid zur Genehmigung U 52/02 zum Umgang mit radioaktiven Stoffen (Konditionierungsanlage FAKIR VI)

6 Schreiben der Bezirksregierung Köln (Az.: 55.8331-GNS-Ra) vom 16.09.2011 an die Bezirksregierung Düsseldorf, betr.: GNS Jülich, Genehmigung U29/2011 zum Betrieb der Trocknungsanlage PETRA und Nutzung von Containerplätzen auf dem Gelände der Forschungszentrum Jülich GmbH (FZJ)

7 GNS
Technische Notiz, 24.08.2012
GNS-Konditionierungsanlage REBEKA
Beantwortung der Fragenliste der Entsorgungskommission vom 06.06.2012

8 Bezirksregierung Köln (Az.: 55.3-Str 2132/08-Ra) vom 25.02.2009 an die GNS – Gesellschaft für Nuklear-Service mbH
Änderungsbescheid zur Genehmigung U 51/02 zum Umgang mit radioaktiven Stoffen (Konditionierungsanlage PETRA VI)

9 Schreiben der Bezirksregierung Köln (Az.: 55.8331-Ra) vom 11.09.2012 an das Ministerium für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung – Landessammelstelle NRW
Antworten zur Fragenliste

[33] Schreiben des Ministeriums für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen (Az.: III 3 – 8331.1) vom 12.09.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung

mit zehn Anlagen

1 Schreiben der GNS Gesellschaft für Nuklear-Service mbH (Az.: Oeh/StB/90221) vom 05.09.2012 an das Ministerium für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung
Beantwortung der Fragenliste zu den genehmigten Betriebsstätten auf dem Gelände des Forschungszentrums Jülich GmbH, in Duisburg auf der Richard-Seiffert-Straße und in Ahaus im Lagerbereich I des Transportbehälterlagers (TBL-A)

2 GNS
Technische Notiz
Transportbehälterlager Ahaus (TBL-A)
Beantwortung der Fragenliste der Entsorgungskommission vom 06.06.2012
29.08.2012

3 Schreiben der Bezirksregierung Münster (Az.: 55.6-bil/TBL-A/ESK) vom 05.09.2012 an das Ministerium für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung
Beantwortung der Fragenliste

4 Schreiben der Bezirksregierung Münster (Az.: 56.3-TBL-A) vom 09.11.2009 an die GNS Gesellschaft für Nuklear-Service mbH, betr.: Genehmigung zur kombinierten Nutzung des Transportbehälterlagers Ahaus (TBL-A) auch zur vorübergehenden Zwischenlagerung sonstiger radioaktiver Stoffe gemäß § 7 Abs. 1 der Strahlenschutzverordnung (StrlSchV)
Zwischenlager TBL-A in Ahaus

5 Schreiben der Bezirksregierung Münster (Az.: 55.6-bil/TBL-A) vom 15.02.2011 an die Brennelement-Zwischenlager Ahaus GmbH (BZA), betr.: Liste der einlagerfähigen Abfallbehälter, Anlage 2 zur Genehmigung TBL-A 01/09 vom 09.11.2009
Neufassung der Liste nach Zustimmung zur Aufnahme des Konrad Container Typ IV EWB Stücklisten-Nr. ST 100901 KC 4 Rev. 2 mit Schreiben vom 29.11.2010 (irrtümlich als KC 3 beantragt)

6 TBL-A
Zwischenlagerung von Betriebs- und Stilllegungsabfällen
Liste der einlagerfähigen Behälter
Rev. 3 (Stand 08.12.2010)

7 Schreiben der Bezirksregierung Münster (Az.: 55.6) vom 17.05.2011 an die GNS Gesellschaft für Nuklear-Service mbH, Werk Ahaus, betr.: Zustimmung zur Aufnahme des Konrad-Containers Typ V (EWB) in die Liste der einlagerfähigen Behälter, Anlage 2 zur Genehmigung TBL-A 01/09

8 TBL-A
Zwischenlagerung von Betriebs- und Stilllegungsabfällen
Liste der einlagerfähigen Behälter
Rev. 4 (Stand 04.05.2011)

9 Schreiben der Bezirksregierung Münster (Az.: 55.6 - TBL-A) vom 27.07.2011 an die Brennelement-Zwischenlager Ahaus GmbH (BZA), betr.: Anpassung der Technischen Annahmebedingungen hinsichtlich der Nuklidvektoren
Ergänzung der Technischen Annahmebedingungen: Lasche 16 des Antrages vom 30.10.2006 zur Genehmigung TBL-A 01/09 vom 09.11.2009
Anlage: Ergänzung der Technischen Annahmebedingungen in Form veränderter Nuklidvektoren

10 Aktivitätsgrenzwerte
Zusammenfassung (Anlage 5 – 14)

[34] Schreiben des Regierungspräsidenten Köln (Az.: 23.8950,11 – ZfS -) vom 01.07.1985 an die Zentralstelle für Sicherheitstechnik, Strahlenschutz und Kerntechnik der Gewerbeaufsicht des Landes Nordrhein-Westfalen, betr.: Genehmigung zum Betrieb der Landessammelstelle für radioaktive Abfälle des Landes Nordrhein-Westfalen

mit acht Anlagen

1 Schreiben der Bezirksregierung Köln (Az.: 55.8331.1-U 88/85-3-H) vom 20.09.2004 an Landesanstalt für Arbeitsschutz, betr.: 3. Nachtrag zur Genehmigung U 88/85 (Bezugsgenehmigung) zum Umgang mit radioaktiven Stoffen (Landessammelstelle, uneingeschränkte Freigabe)

2 Matrix zur Beantwortung der Frage 1
Anlage: Landessammelstelle NRW

3 Schreiben des Regierungspräsidenten Köln (Az.: 23.8950,11 – ZfS -) vom 15.10.1987 an die Zentralstelle für Sicherheitstechnik, Strahlenschutz und Kerntechnik der Gewerbeaufsicht des Landes Nordrhein-Westfalen,
betr.: 1. Nachtrag zur Genehmigung zum Betrieb der Landessammelstelle für radioaktive Abfälle des Landes Nordrhein-Westfalen

4 Ministerialblatt für das Land Nordrhein-Westfalen, 64. Jahrgang, Nummer 28, Ausgegeben zu Düsseldorf am 16.11.2011
Veröffentlichungen

5 Matrix zur Beantwortung der Frage 2
Anlage: Landessammelstelle NRW

6 Schreiben des Regierungspräsidenten Köln (Az.: 23.8950.11 – ZfS -) vom 07.09.1989 an die Zentralstelle für Sicherheitstechnik, Strahlenschutz und Kerntechnik der Gewerbeaufsicht des Landes Nordrhein-Westfalen,
betr.: 2. Nachtrag zur Genehmigung zum Betrieb der Landessammelstelle für radioaktive Abfälle des Landes Nordrhein-Westfalen

7 Schreiben der Bezirksregierung Köln (Az.: 55.2-LSSt/Sta – 8331.1) vom 30.08.2012 an das Ministerium für Arbeit, Integration und Soziales Nordrhein-Westfalen, betr.: Durchführung der Strahlenschutzverordnung, Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung – Landessammelstelle für radioaktive Abfälle NRW
Beantwortung der Fragen

8 Schreiben des Ministeriums für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen (Az.: III 3 – 8331.1) vom 10.09.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung

[35] Schreiben des Ministeriums für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen (Az.: III 3 – 8331.1) vom 07.09.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung

mit zehn Anlagen

1 Schreiben der Bezirksregierung Detmold (Az.: 55.45D) vom 31.08.2012 an das Ministeriums für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Zwischenlager TBH-KWW Würgassen und Deutsche Bahn AG Umweltschutz Strahlenschutzmanagement, Minden

2 Matrix zur Beantwortung der Frage 1
Anlage: Strahlenschutzlabor der Deutschen Bahn AG

3 Auszug aus dem BHB
Anforderungen an die Abfallgebinde und Verpackungen

4 Schreiben der Bezirksregierung Detmold (Az.: 55.13.8950.1B) vom 17.02.1995 an die Deutsche Bahn AG, Zentralbereich, Forschung und Versuche, betr.: Genehmigung U 05-95 zum Umgang mit radioaktiven Stoffen, hier: Lagerung und Volumenreduzierung

5 Schreiben des Staatlichen Amtes für Umwelt und Arbeitsschutz OWL (Az.: 8331.1 – TBH – KWW) vom 28.12.2005 an die E.ON Kernkraft GmbH, betr.: Genehmigung zur längerfristigen Zwischenlagerung von schwach radioaktiven Abfällen mit vernachlässigbarer Wärmeentwicklung nach § 7 Abs. 1 der Strahlenschutzverordnung (StrlSchV); Zwischenlager in Beverungen
Genehmigung U 10-05
- Zwischenlager TBH-KWW –

6 Schreiben der E.ON Kernkraft GmbH (Az.: TRG-Klas/Bü) vom 13.08.2012 an das Ministerium für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen, betr.: Kernkraftwerk Würgassen (KWW) – Transportbereitstellungshalle (TBH-KWW)
Durchführung der Strahlenschutzverordnung (StrlSchV)
Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung
– Transportbereitstellungshalle beim KWW Würgassen
Beantwortung der Fragenliste

7 Schreiben der Deutsche Bahn AG (Az.: TUM 4 Kr Tssu1) vom 30.08.2012 an das Ministerium für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV) Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung Beantwortung der Fragenliste

8 Matrix zur Beantwortung der Frage 2
Anlage: Strahlenschutzlabor der Deutschen Bahn AG

9 Schreiben der Bezirksregierung Detmold (Az.: 55.13.8950.1B) vom 01.02.1996 an die Deutsche Bahn AG, betr.: 1. Nachtrag zur Genehmigung U 05-95 zum Umgang mit radioaktiven Stoffen, hier: Dekontamination, Lagerung und Volumenreduzierung

10 Anlagen- sowie genehmigungssortierte Zusammenfassung zur übergeordneten Frageliste der ESK für den Stresstest für Anlagenkategorien 4 und 5, Abgefragte Anlagen des Forschungszentrums Jülich, des Kernkraftwerks Würgassen und des HKG THTR 300 am Standort Hamm-Uentrop

[36] Schreiben des Ministeriums für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen (Az.: III 3 – 8331.1) vom 25.07.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, betr.: Durchführung der Strahlenschutzverordnung (StrlSchV), Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung

mit drei Anlagen

1 Schreiben der Bezirksregierung Köln (Az.: 55.8331-U28/2005-1-Ra) vom 26.09.2011 an die Arbeitsgemeinschaft Versuchsreaktor GmbH, betr.: 1. Nachtrag zur Genehmigung U 28/2005
Änderung des Betriebs des Zwischenlagers (RB-ZL) für den AVR-Reaktorbehälter

2 TÜV Arbeitsgemeinschaft Kerntechnik West
Sicherheitsgutachten zum AVR-Reaktorbehälter-Zwischenlager auf dem Geländes des Forschungszentrums Jülich GmbH
Köln, Oktober 2008

3 Bezirksregierung Köln (Az.: 55.8331-GenU 28/2005-Ra) vom 01.03.2010
Genehmigung U 28/2005
Betrieb des Zwischenlagers (RB-ZL) für den AVR-Reaktorbehälter

[37] Schreiben des Bayerischen Staatsministeriums (Az.: 97-U8811.00-2012/13-6) vom 10.09.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung; Fragenliste der Entsorgungskommission vom 06. Juni 2012; Bayern, Teil 3

mit drei Anlagen

1 Schreiben der E.ON Kernkraft GmbH (Az.: bur-sm) vom 08.08.2012 an das Bayerische Staatsministerium, betr.: Kernkraftwerk Grafenrheinfeld (KKG), Vollzug des § 19 AtG; Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung; Beantwortung der Fragenliste der Entsorgungskommission vom 06.06.2012

2 Schreiben der E.ON Kernkraft GmbH (Az.: TÜ-Br) vom 02.08.2012 an das Bayerische Staatsministerium, betr.: Kernkraftwerke Isar 1 und Isar 2 (KKI-1, KKI-2), Vollzug des § 19 AtG; Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung; Beantwortung der Fragenliste der Entsorgungskommission vom 06.06.2012

3 Schreiben der Kernkraftwerk Gundremmingen GmbH (Az.: A-50/233/RSK) vom 06.08.2012 an das Bayerische Staatsministerium, betr.: Kernkraftwerk Gundremmingen (KRB-II), Block A, Blöcke B und C, Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung; übergeordnete Fragenliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5 vom 06.06.2012
Beantwortung der Fragen

[38] Schreiben des Bayerischen Staatsministeriums (Az.: 93b-U8808.16-2012/12-7) vom 10.09.2012 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU), betr.: Übergeordnete Frageliste der ESK für den Stresstest für die Anlagenkategorien 4 und 5
Beantwortung der Fragen

[39] Frageliste der ESK für den Stresstest für das Endlager Konrad, die Schachtanlage Asse II und das Endlager für radioaktive Abfälle Morsleben (ERAM), 28.01.2013, versandt an das BfS, Endlagerüberwachung, mit BMU-Schreiben vom 31.01.2013

[40] Schreiben des Bundesamt für Strahlenschutz (BfS) (Az.: AG-Se-07482/02#0005) vom 28.02.2013 an das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, betr.: Sicherheitsüberprüfung von Anlagen und Einrichtungen der Ver- und Entsorgung, Fragenliste der ESK vom 28.01.2013

mit acht Anlagen

1 ASSE GmbH
Mitteilung des Bestandes an radioaktiven Stoffen am 31.12.12
gemäß § 70 Abs. 1 Nr. 3 StrlSchV
Schachtanlage Asse II

2 Niedersächsisches Ministerium für Umwelt und Klimaschutz
Genehmigungsbescheid für die Schachtanlage Asse II
Bescheid 2/2010
Umgang mit radioaktiven Stoffen gemäß § 7 Strahlenschutzverordnung (StrlSchV)

3 Niedersächsisches Ministerium für Umwelt und Klimaschutz
Genehmigungsbescheid für die Schachtanlage Asse II
Bescheid1/2011
Umgang mit Kernbrennstoffen gemäß § 9 Atomgesetz (AtG)
Faktenerhebung Schritt 1

4 Niedersächsisches Ministerium für Umwelt und Klimaschutz
Genehmigungsbescheid für die Schachtanlage Asse II
Bescheid 2/2011
Umgang mit radioaktiven Stoffen gemäß § 7 Strahlenschutzverordnung (StrlSchV)

5 Peter Brennecke / BfS
Anforderungen an endzulagernde radioaktive Abfälle
(Endlagerungsbedingungen, Stand: Oktober 2010)
- Endlager Konrad –
Fachbereich Sicherheit nuklearer Entsorgung
SE-IB-29/08-REV-1

6 Niedersächsisches Umweltministerium
Planfeststellungsbeschluss Konrad
Planfeststellungsbeschluss für die Errichtung und den Betrieb des Bergwerkes Konrad in Salzgitter als Anlage zur Endlagerung fester oder verfestigter radioaktiver Abfälle mit vernachlässigbarer Wärmeentwicklung
vom 22. Mai 2002

7 DBE
Bestandsnachweis über umschlossene Strahlenquellen, Prüfstrahler und Referenzlösungen im ERAM
12.11.2012

8 Schreiben des Ministeriums für Landwirtschaft und Umwelt Sachsen-Anhalt (Az.: 16.5/40340/7) vom 16.06.2004
23. Änderung der Dauerbetriebsgenehmigung (DBG) für das Endlager für radioaktive Abfälle Morsleben (ERAM)
hier: Erstreckung der Dauerbetriebsgenehmigung für das ERAM auf den Umgang mit sonstigen radioaktiven Stoffen

[41] Strahlenschutzkommission (SSK) des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Radiologische Grundlagen für Entscheidungen über Maßnahmen zum Schutz der Bevölkerung bei unfallbedingten Freisetzungen von Radionukliden, mit Rahmenempfehlungen für den Katastrophenschutz in der Umgebung kerntechnischer Anlagen und
Leitfaden zur Information der Öffentlichkeit in kerntechnischen Notfällen
Berichte der SSK Heft 61, 2009

[42] Sicherheitsanforderungen an Kernkraftwerke
Bekanntmachung des BMU vom 20.11.2012

[43] Strahlenschutzkommission (SSK) des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Leitfaden für den Fachberater Strahlenschutz der Katastrophenschutzleitung bei kerntechnischen Notfällen, Berichte der SSK, Heft 37, 2004

[44] Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit (BMU)
Allgemeine Verwaltungsvorschrift zu § 47 StrlSchV
Ermittlung der Strahlenexposition durch die Ableitung radioaktiver Stoffe aus Anlagen oder Einrichtungen vom 28.08.2012, BAnz AT 05.09.2012 B1

[45] Physikalisch-Technische Bundesanstalt (PTB)
Systemanalyse Konrad, Teil 3
Bestimmung störfallbedingter Aktivitätsfreisetzung
GRS-Bericht GRS-A-1389, November 1987

[46] Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit (BMU)
Freisetzung von Radionukliden bei Störfällen in Anlagen des Brennstoffkreislaufes – Experimentelle Kenntnisse
GRS-A-1686, Juli 1990

[47] Gesellschaft für Anlagen- und Reaktorsicherheit (GRS)
Transportstudie Konrad 2009
Sicherheitsanalyse zur Beförderung radioaktiver Abfälle zum Endlager Konrad
GRS–256, Dezember 2009 mit Corrigendum vom April 2010

[48] Strahlenschutzkommission (SSK) des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Störfallberechnungsgrundlagen zu § 49 StrlSchV - Neufassung des Kapitels 4: Berechnung der Strahlenexposition, Empfehlung der SSK, verabschiedet in der 186. Sitzung der SSK am 11. September 2003

[49] Bundesamt für Strahlenschutz (BfS)
Ressortforschungsberichte zur kerntechnischen Sicherheit und zum Strahlenschutz
Bewertung der radiologischen Relevanz der sich am Standort eines KKW befindenden Inventare (außer Kerninventar) als Input für das Entscheidungshilfesystem RODOS
-Vorhaben 3608S06006, November 2012

[50] Strahlenschutzkommission (SSK) des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit
Rahmenempfehlungen für den Katastrophenschutz in der Umgebung kerntechnischer Anlagen, Stand 21.09.2008
veröffentlicht im GMBl. Nr. 62/63 vom 19.12.2008

Annex 1 (editorially revised version of 30.7.2013)

List

- **of storage facilities for low- and intermediate-level radioactive waste, and**
- **of conditioning facilities for low- and intermediate-level radioactive waste for the ESK safety review**

The first column contains the name of the facility.

The second column contains information on the site and the *Land* where the facility is located.

In the third column, the limitations of the total activity are shown, as far as known or specified, in some cases related to e.g. individual parts or radionuclides. In cases where the licence refers to a multiple of the exemption levels pursuant to Appendix III, Table 1, Column 2 of the Radiation Protection Ordinance (StrlSchV), for example, 1E10 FG is given for 1E10-times the exemption levels.

Facility	Location, *Land*	Total activity, other data
Storage facilities for low- and intermediate-level radioactive waste		
1. Storage facilities for radioactive waste – central storage facilities		
Gorleben waste storage facility	Gorleben, NI	5E18 Bq
EVU storage hall (in the GRB collecting facility Bayern)	Mitterteich, BY	Approx. 4E10 FG 40,000 packages
Storage facility North (ZLN) (halls 1 - 7) including the *Land* collecting facility Mecklenburg-Vorpommern	Greifswald, MV	4.5E17 Bq
Storage facility of the HDB of company WAK GmbH including the *Land* collecting facility Baden-Württemberg	Karlsruhe, BW	HDB: storage bunker building 563, storage facilities II and III, building 519/526, buffer storage facility building 529, residual material storage facility building 535, storage facility for radioactive debris building 470 - inventory limitations are defined for the individual facilities - total inventory approx. 4E17 Bq
Storage facility transport cask storage facility Ahaus – storage area I	Ahaus, NW	1E17 Bq reference nuclide Co-60
2. Storage facilities for radioactive waste – on-site storage facilities (NPP in operation or operating licence expired)		
BZL Hall 2 Biblis	Premises of the NPPs Biblis A and B, HE	1E17 Bq (total activity), specific licence according to § 7 StrlSchV
Halls for keeping ready for transport TBH I and TBH II of NPP Brunsbüttel	Premises of NPP Brunsbüttel, SH	TBH I: 1E17 Bq TBH II: 1E17 Bq, specific licence according to § 7 StrlSchV
Storage facility and dispatch station KKU-LUW	Premises of NPP Unterweser, NI	1.85E15 Bq
3. Storage facilities for radioactive waste – storage facilities in NPPs (in decommissioning)		
Storage facility for decommissioning waste in auxiliary facilities, services and reactor building of decommissioned Unit A	NPP Gundremmingen Unit A, BY	1.85E17 Bq
Storage rooms for operational and decommissioning waste of the THTR within safe enclosure and the supervised area	Premises of the THTR Hamm-Uentrop, NW	No activity limitation
Storage facility (RB-ZL) for the AVR reactor vessel	Premises of the AVR, Jülich, NW	Approx. 2.8E14 Bq (limitation of individual nuclides)
Storage facilities for operational and decommissioning waste in NPP Lingen	Premises of NPP Lingen, NI	No activity limitation

Facility	**Location, *Land***	**Total activity, other data**
Storage facilities in buildings 39 and 52 as well as open landscape of NPP Obrigheim	Controlled and supervised area of NPP Obrigheim, BW	Storage facilities in buildings 39 and 52: 4,000 m³ 1E17 Bq (operational and post-operational waste)
Storage and conditioning facilities für decommissioning waste of the KMK[3]	Controlled and supervised area of NPP Mülheim-Kärlich, RP	Limitation results for total inventory in the KMK of 1E15 Bq
Storage facility for radioactive waste (LarA) of NPP Stade	Premises of NPP Stade, NI	1E17 Bq (operational and post-operational waste)
NPP Würgassen (decommissioning waste): • UNS storage facility • cask storage position 3 and 4 • storage facility TBH-KWW (former transport cask storage facility)	Premises of NPP Würgassen, NW	UNS: 1E17 Bq (specific licence until 31.12.2033). Cask storage position 3 and 4 (for facility components, residual material and waste): 70 20‘ containers, no activity limitation, integrated in dismantling licence TBH: 4E13 Bq, integrated in dismantling licence
Buffer storage and keeping ready for transport on the premises of the KKR	Premises of NPP Rheinsberg, Brandenburg	No activity limitation
4. Storage facilities for radioactive waste – storage facilities in research institutions		
Research neutron source (FRM-II) Research reactor Munich (FRM)	Garching, BY	FRM-II: keeping ready for transport on the basis of the handling authorised with the operating licence “to the extent necessary for operation” FRM: Storage of removed components of the FRM in the service building, no separate waste storage facility, “to the extent necessary for operation”
Hall for keeping ready waste from the GKSS / of the HZG in building 44	Premises of the Helmholtz Zentrum Geesthacht, SH	<1E10 FG für sealed radioactive material (to be dealt with in connection with HAKONA since the same building is concerned)
HAKONA (storage facility for dismantling waste of the Otto Hahn nuclear ship) in building 44 including drop shaft with RPV of the Otto Hahn	Premises of the Helmholtz Zentrum Geesthacht, SH	1.48E16 Bq (sealed)

[3] The supervisory authority explicitly points out that it is not a facility of the nuclear fuel cycle and that, when including the KMK, reference should not be made to a stress test for nuclear fuel cycle facilities.

Facility	Location, *Land*	Total activity, other data
N-DZ, Nuklearservice-Hall II, building 12.6 of the Forschungszentrum Jülich (FZJ),	Premises of the FZJ, NW	Conditioning and storage of radioactive waste from the Institutes and departments: >1E7 FG (unsealed), 1E10 FG (sealed)
Waste storage facility of the operational department decontamination (TD-DE)	Premises of the Forschungszentrum Jülich (FZJ), NW	8E15 Bq
Storage facility Rossendorf (ZLR)	Premises of the Helmholtz-Zentrum Dresden-Rossendorf (HZDR) research centre, SN	3.53E10 FG
5. Storage facilities for radioactive waste – storage facilities of the nuclear industry		
Storage facility of the Advanced Nuclear Fuels GmbH (ANF) (operational waste)	Lingen, NI	Dealt with in connection with the fabrication plant
Siemens site Karlstein building 38	Premises of the Siemens AG at the Karlstein site, BY	5E10 FG (licensed) 6.6E8 FG (at present) (waste from dismantling and operation)
NCS Hall 12	Hanau, HE	2E16 Bq (total activity)
Storage facility for radioactive waste of company Nuclitec GmbH	Leese, NI	1E12 FG
Urenco, Gronau, waste storage	Gronau, NI	Dealt with in connection with the enrichment plants
6. Storage facilities for radioactive waste – *Land* collecting facilities		
Land collecting facility Bavaria (LBA) in the GRB collecting facility Bavaria	Mitterteich, BY	10,000 packages max., no limitation of activity inventory, permissible inventory per m³ only limited for raw waste: 9.25E9 Bq (combustible), 1.85E10 Bq (non-combustible), inventory alpha emitters 1.85E8 Bq max.
Land collecting facility Baden-Württemberg	HDB Karlsruhe, BW	No specific consideration since dealt with within the licence for the HDB (see 4.1)
Facility for central collection of radioactive waste of the *Land* of Berlin (ZRA)	Premises of the Helmholtz-Zentrum Berlin, BE	5.0E12 FG
Land collecting facility NRW	Premises of the Forschungszentrum Jülich (FZJ), NW	2.6E14 Bq
7. Storage facilities and facilities for conditioning within the licensing scope of NPPs (Part 3 of the list of questions)		

Facility	Location, *Land*	Total activity, other data
Container storage facility of KKI	NPP Isar (KKI), BY	Inventory not limited
Hall for keeping ready for transport of KKI	NPP Isar (KKI), BY	8.124E15 Bq
Disposal building with a covered storage facility in the open of NPP Grafenrheinfeld	NPP Grafenrheinfeld (KKG), BY	No activity limitation for raw waste, dealt with within the operating licence pursuant to § 7 AtG Conditioning of ion exchange resins and evaporator concentrate on site
Storage facility in the auxiliary facilities and services building of KRB II	NPP Gundremmingen (KRB II), BY	No activity limitation
Storage hall and hall for keeping ready for transport L94 and L95 of KRB	Premises of NPP Gundremmingen, BY	No activity limitation
Mobile conditioning facility MAVAK of KRB	Premises of NPP Gundremmingen II (KRB II), BY	Beta/gamma: 1E13 Bq, alpha: 1E10 Bq
Drum storage facility I in the reactor auxiliary building of GKN 1	NPP Neckarwestheim (GKN) 1, BW	No activity limitation
Drum storage facility II in the reactor auxiliary building of GKN 2	NPP Neckarwestheim (GKN) 2, BW	No activity limitation
Storage facility in the UKT building	Supervised area of NPP Neckarwestheim, BW	No activity limitation
Drum storage facility I in the reactor auxiliary building of KKP I	NPP Philippsburg (KKP) I, BW	No activity limitation
Drum storage facility II in the reactor auxiliary building of KKP II	NPP Philippsburg (KKP) II, BW	No activity limitation
Halls for keeping ready for transport TBH 1 and 2	Supervised area of NPP Philippsburg, BW	No activity limitation
LAW-Lager Biblis	Premises of NPP Biblis (KWB), HE	3.071E15 Bq (total activity)
Conditioning and storage facilities at KWB Unit-A	NPP Biblis A (KWB-A), HE	No activity limitation
Conditioning and storage facilities at KWB Unit-B	NPP Biblis B (KWB-B), HE	No activity limitation
Storage and conditioning in the area of NPPs - Unterweser - Grohnde - Emsland	Premises of NPPs Unterweser, NI, Grohnde, NI, Emsland, NI	NMU sees no need for a review due the already performed RSK stress test for the NPPs in operation. Data have not been submitted.

Facility	Location, *Land*	Total activity, other data
Storage and conditioning in the area of NPPs - Krümmel - Brunsbüttel - Brokdorf	Premises of NPPs Krümmel, SH, Brunsbüttel, SH, Brokdorf, SH	MELUR sees no need for a review due the already performed RSK stress test for the NPPs in operation. Data have not been submitted.
Facilities for conditioning of low- and intermediate-level radioactive waste (for own needs and for third parties)		
Conditioning facilities of the GNS	GNS operating sites Duisburg, NW	Total activity 5.0E12 Bq (reference nuclides Co-60 and Cs-137) Raw waste < 1E5 Bq/g
Conditioning facilities (Rebeka) of the GNS in building 12.3 of the FZJ	Premises of the Forschungszentrum Jülich, NW	Total activity of other radioactive material: 9E12 Bq; H-3: 5E10 Bq; I-131 (equivalent): 1E7 Bq
Drying facility TAJ of the GNS near the FZJ	Jülich, NW	2.5E13 Bq
Conditioning facilities of the FZJ GmbH in the FZJ (nuclear services department, building 12.6)	Jülich, NW	Conditioning and storage building 12.6: >1E7 FG (unsealed) and >1E10 FG (sealed), resp.
Nuclear facilities for dealing with radioactive waste in the FZJ	Jülich, NW	Large hot cells: 1E12 Bq (unsealed) Chemistry cells: 1E12 Bq (unsealed) Hot Material Laboratory 1E11 Bq (unsealed) Waste cells: 2.2E12 Bq (unsealed) All data refer to licensed levels, current inventories are also available
Conditioning facilities of the Eckert & Ziegler Nuclitec GmbH	Braunschweig, NI	1E10 FG (inventory limitation to 86E10 FG for all facilities including source manufacturing)
Zentrale Aktive Werkstatt ZAW and Zentrale Dekontaminationswerkstatt ZDW of the EWN GmbH	Premises of NPP Greifswald, Lubmin, MV	ZAW: 1E10 FG (only nuclides from LWR) ZDW: licence not granted yet
Conditioning facilities of the HDB	Karlsruhe, BW	Volumes handled are specified in the individual licences for each facility. Total inventory approx. 5E15Bq
Facility for the treatment of low-level radioactive waste Rossendorf (ESR)	Helmholtz-Zentrum Dresden-Rossendorf (HZDR) research centre, SN	1.3E8 FG (unsealed radioactive material)

Facility	Location, *Land*	Total activity, other data
Conditioning facilities at KRB A	NPP Gundremmingen A (KRB A), BY	Data on licensed activities not differentiated according to storage and conditioning: 1.85E17 Bq (1st decommissioning licence KRB-A) 3.7E14 Bq (2nd supplementary licence) for activities from KRB II and VAK[4]
Storage and conditioning facilities in the health physics laboratory of the Deutsche Bahn AG Minden	Health physics laboratory and premises of the DB AG Minden, NW	1.07E13 Bq[5] unsealed and sealed radioactive material, material-specific activity limitations exist

*Translator's note:
Second column:
The *Land* codes used are as follows:
BE = Berlin
BW = Baden-Württemberg
BY = Bayern (Bavaria)
HE = Hessen (Hesse)
MV = Mecklenburg-Vorpommern (Mecklenburg-West Pomerania)
NI = Niedersachsen (Lower Saxony)
NW = Nordrhein-Westfalen (North Rhine-Westphalia)
RP = Rheinland-Pfalz (Rhineland-Palatinate)
SH = Schleswig-Holstein
SN = Sachsen (Saxony)
Third column:
FG = German abbreviation for "Freigrenze" (exemption level)

4 Increase to 3.7E15 Bq has been applied for

5 DB AG intends to limit the inventory applied for to values below the exemption levels in the near future.